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THE JOURNAL OF PERIODONTOLOGY is published to serve as the professional journal of periodontia; to keep dentists in touch with research being carried on in this field and related sciences; to stimulate greater interest in the supporting tissues of the teeth and their relation to oral and general health. The plan to continue the publication of abstracts indefinitely will make the Journal a fund of extensive information, readily available to students, teachers, researchers, and clinicians.

The Journal is the official organ of the American Academy of Periodontology and will contain, therefore, those papers of scientific and clinical interest which are presented at the annual meetings of that society. Abstracts of important articles related to periodontology that appeared during the year of 1945 are published in this year's issues.

We are grateful to all who have made available the subject matter from which the abstracts and copies of abstracts have been made, including the authors of the original articles, owners of the journals mentioned in the text of the abstract section, and those who have aided by contributing the material for this issue.

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JULY, NINETEEN HUNDRED FORTY-SIX

Starvation Diets and Their Effects Upon the Mouth

By R. GORDON AGNEW, M.Sc., D.D.S., Ph.D., *Chengtu, Szechwan, China**

INTRODUCTION

CONDITIONS affecting both military and civilian personnel in many areas of Europe and of Asia during World War II and during the postwar period have been such as to afford many opportunities for the study of states of starvation, near-starvation, and of marked nutritional deprivation. Modern warfare involves such extensive areas of the belligerent countries and frequently so large a percentage of the populations concerned as to approximate "total war" in its profound effects. The nutritional resources of the countries concerned are depleted to a degree unknown in history.

In World War II not only were food resources seriously depleted by the direct and indirect effects of combat—reduction of agricultural and related personnel, physical damage, and interference with the means of production—but in many areas not directly affected by war operations, and ordinarily productive, calamities such as drought and floods, have ruined crops and added grievously to the total picture of distress and want. In many zones, mass movements of refugees have, without contributing to manpower and food yield, constituted abnormal demands with resultant inability of districts, normally of the "surplus" type, to meet immediate needs, much less to contribute to other places of want.

In the space of this article no attempt will be made to map or describe in detail the various areas in Europe and Asia in which pertain such conditions as have been mentioned. In illustration I shall emphasize the conditions existing in China with which I am personally most familiar. Here the direct effects of warfare have laid waste large areas of normally productive land and have crippled or paralyzed communications which have never, even in times of peace, been adequate. Floods in China and in Indo-China have further contributed to the widespread food shortage. Famine is rampant in South Kwangtung and Honan, at the time of writing; and in Hunan province it is estimated that five million face death—living on grasses, roots, and herbs. In Kweichow drought has so damaged crops that only 40-60 per cent of the 1945 crop will be available in 1946; and this province is called upon to support some two million refugees and large numbers of soldiers, in addition to its

**West China Union University*

normal population. War-inflation persists on an almost incredible scale, with costs of essential commodities several thousand *times* the prewar level (1937).

It is beyond the scope of this presentation to discuss the international aspects of this crucial world situation. Not only is the food shortage throughout large areas of the world a relative shortage, i.e. due, in part, to inadequacy of communications or of appropriate international organization, but there is today an absolute shortage of foodstuffs. This will be relieved to a degree if current crops are up to expectations; however, expert opinion indicates that the absolute world shortage may carry well into 1947. Social and economic philosophies are inevitably inter-related with the problem of alleviation and of prevention of further crises of this sort. Sociological problems include that of over-population in several areas of Europe and Asia. It is estimated that, in spite of the toll of war, there are one hundred million more people in the world today than in 1939 (35 million of these in India alone). There is evidence to suggest that under conditions of changed environment, more favorable economic conditions, and more stimulating social outlook, some degree of favorable population control may be expected. (For example, in Canada it has been found that among citizens of Japanese origin in British Columbia, the average family totals four persons; and the birth-rate is similar to or slightly lower than the average for the country as a whole.) Intervention of the United Nations through UNRRA, and the activities of other philanthropic agencies have accomplished much in direct and indirect relief, and in the cementing of more cordial international relations. However, fundamental removal of basic causes and prevention of recurrence will require a resolution of economic, ideologic and philosophic differences, such as has not yet been approximated.

The purpose of this presentation is to correlate available data on starvation, near-starvation, and marked deprivation states, with particular reference to mouth conditions.

Unfortunately, published reports on recent studies in Europe and the East deal in few instances with detailed findings regarding the mouth and teeth. Further I am handicapped in that, flying from China across the Pacific ocean to San Francisco, the transportation agencies misplaced my baggage containing data on the Chinese situation; and at the time of writing, this data has not yet come to hand. Consequently, this presentation is strictly of a preliminary nature.

CLASSIFICATION OF NUTRITIONAL STATES

For purposes of this presentation nutritional states (human) may be classified as:

1. *Starvation*—Leading, within brief periods, to collapse and death.
2. *Near-starvation* (border-line starvation)—in which the strongest survive for an indefinite period and the weakest are eliminated.
3. *Suboptimal Nutrition*—General maintenance of life, but at suboptimal levels of health, activity, and creativity.
4. *Optimal Nutrition*—Conducive to optimal physical and mental function —the goal of contemporary nutritional programs.

BORDERLINE OR SUBCLINICAL STATES

Dividing-lines between near-starvation and suboptimal nutritional states, and between suboptimal and optimal nutritional states are often not susceptible to definitive establishment. It is widely recognized that such borderline conditions constitute a major problem both to the diagnostician and to the research worker.

After many years of residence and observation in the East, I have felt that the often described "lethargy" of the East, with its low energy output, and, frequently, low levels of creativity, may be attributed, not so much to hereditary, climatic and related causes, but rather to the effects of long-continued dietary inadequacy. It has been interesting to observe the differences of behavior in play between the children of families in China unenlightened as to dietary balance and those of families, for example, of Chinese teachers in universities in which an active health program has made modern dietary information available. Lassitude and casual play give way to boisterous and vigorous activity. (The above refers, of course, to conditions prior to the development of extreme war-inflation and food scarcity.)

RELATION OF CALORIC INTAKE TO SURVIVAL AND ACTIVITY

While there is not complete unanimity as to the exact relation of caloric intake to activity nor is there, of necessity, any precise data on general nutritional levels, it is assumed that, as recently quoted in *Time:*

a) The human minimum intake for activity—2200 calories
b) On 700 calories a man may stay alive if he stays in bed, with warm covering
On 1000 calories he may walk around his room
On 1300 calories he may perform light work
c) However it is commonly considered that 1500 calories is minimum for mere body maintenance; and that below this level the body begins to feed on its own tissues
d) Average citizen in U.S.A. has intake of 3200 calories
e) U. S. Army standard is 3600 calories

Contrasted with the above are the following data available at the time of presentation:

a) Fifty-five million city dwellers in India subsist on 960 calories with probability of further reduction
b) Italy average (March, 1946)—1300
c) West Holland—1000 to 500
d) Germany—from 1500 to 940 calories

GENERAL CHARACTERISTICS OF STARVATION[1]

1. *Emaciation.*—There is progressive thinning of the body, with a typical picture in children of narrow shoulders, protruding larynx, spidery legs, and relatively large eyes. Muscular atrophy may be advanced in severe cases. The

[1] (NOTE: The following picture of the effects of starvation and near-starvation, in both general and specialized fields, is a composite one; and I have incorporated into it data available from many areas—Western Holland; Germany; Italy; Greece; China; and India; Manitoba (Indians); Newfoundland; and other areas. The appropriate sources and references are appended in the bibliography.)

growth impulse is retarded in children, although, in less severe cases, the growth impulse may continue to cause increase in height of the skeleton while the muscles and body breadth are poorly developed. The body attempts to compensate the caloric deficiency by burning its own tissues. Loss of weight is due chiefly to loss of fat; but also, in severe cases, to loss of protein. Fat layers between muscles and around vital organs disappear. Loss of the fat which normally supports the organs—stomach, kidney, and uterus,—against the effects of gravity, results in their displacement (visceroptosis). Lost body fat is partially replaced by water.

Basal metabolic rate is lowered to 70% of normal or less; specific dynamic response to food is increased. Body temperature is sub-normal and blood pressure is lowered. The individual is abnormally sensitive to cold, since the vessels of the skin are constricted in the attempt to reduce dissipation of heat through radiation and convection, and skin temperature is therefore lowered. (It was found in West Holland that skin temperature frequently dropped to 35° C. or lower especially in winter.)

2. *Bodily and Mental Exhaustion and Mental Apathy.*—There is lack of desire for physical exertion and ready fatigue. Children are commonly depressed and will lie curled up throughout the day with so little motion that the edematous skin acquires deep impressions from the straw mat or other ground covering. There is a tendency to collapse on standing for any length of time; this may vary with the degree of edema.

Cerebration is commonly observed to be very slow; consequently procedures such as history-taking are tedious. Neurotic behaviour patterns are common.

3. *Increased Susceptibility to Infection.*—Diphtheria, malaria, typhus, bacillary dysentery, typhoid and paratyphoid, septicemia, have been reported. Tuberculosis is commonly increased. In West China colleges, under peacetime suboptimal nutritional conditions, approximately 10 per cent incidence of active tuberculosis is found. Under war conditions, i.e. large refugee student population, although food situation did not exceed a state of partial deprivation, this incidence rose to 14 per cent of student-teacher community.

4. *Loss of Hair.*—It has been observed that the normal silky lustre of Chinese hair is lost; the hair becomes dry and unmanageable after several months of slow starvation; tends also to stand on end. Similar observations have been made among malnourished Manitoba Indians.

5. *Edema.*—This is often the most conspicuous clinical evidence of starvation. It is popularly called "wet starvation" in contradistinction to "dry starvation" in which edema is not a dominant element.

Edema frequently occurs first on the dorsal aspect of the feet; (commonly observed in South China). The feet become progressively more swollen until the skin is tightly stretched and shows a bluish transparency. Later, under tension, the skin gives way and multiple fissures, with marked serous discharge, appear; these fissures become readily infected with the production of deep gangrenous ulcers. Observers in China also commonly encounter ulcers due

to the use of various local preparations by unqualified "doctors". The edema spreads up the leg, distending the skin and producing a characteristic glaze. Laycock points out that disappearance of this glaze was the first evidence of the subsidence of the edema. The edema may involve the entire limb up to the groin or it may stop abruptly above the lower third of the thigh. Occurring in the popliteal fossa edema may prevent extension of the knees requiring the patient to walk with knees flexed. The disappearance of edema under treatment is in inverse sequence to its development, the feet being last to return to normal. External genitalia are often affected by edema, and the condition further complicated by eczema of the scrotum.

Pitting edema occurs over trunk and arms; and the backs of the hands are affected most quickly and most seriously. In West Holland edema of legs was more common than that of the arms and hands; all degrees were seen, from slight puffiness around the ankles to severe edema of lower and upper legs, abdomen, and loins.

Serous effusions were infrequent in Kwangtung even where edema was extreme. Some cases in West Holland, and in Szechwan were complicated by ascites.

The face is often grossly edematous, with the eyes completely closed. It was observed that there was a strong tendency for edema to shift with gravity and thus the whole appearance of the face would alter overnight. Particularly in cases where the edema had partially subsided, the whole face would sag, the swelling disappearing last from the lower part of the cheeks. The corners of the mouth drooped and unnatural creases appeared around the eyes and radiated from the alae nasi; these creases did not add expression to the face, which was ordinarily gloomy or expressionless, but rendered the features repulsive. Pigmentation of the face has also been noted, not limited to areas exposed to the sun, as in pellagra.

Due to non-familiarity with the evidences of malnutrition, some non-professional observers have mistaken moderate facial edema for evidence of fair nutrition; and this has given rise to some misleading reports.

Where the face is non-edematous, the skin may be pale, with a dun pigmentation. West Holland reports indicate frequency of petechiae, also large superficial hemorrhages in the skin of the face and of the backs of the hands; these hemorrhages may leave no pigmentation on absorption; also, in this area, edema of the face occurred less often than in the lower body. Further, in non-edematous parts of the body, the skin of edematous patients was desiccated, with diminished elasticity; cyanosis in the skin of the extremities occurred.

In China it was observed that, under starvation conditions amenorrhea and sterility were very common, affecting both refugee and non-refugee women; these conditions were found to be almost invariably present in edematous cases.

The claim has been made by some, that relatively few cases of starvation show general edema; and reference is made to the many photographs of concentration camps which have been published. However, this is scarcely

borne out by reports from Asia and sections of Europe. Further data and careful correlation of observations will be needed to establish its relative incidence.

Famine or hunger edema is believed to be a hypoproteinemia. "Available protein helps to maintain a normal collodial osmotic pressure in the bloodstream and in the capillary bed; protein deficiencies probably do not disturb physico-chemical conditions to the extent that water is retained in the body—but cause reduction in the amount of urine secreted; cause hemoconcentration and facilitate pseudo-obstructive manifestations." (Youmans).

Any bowel infection, such as bacillary dysentery, was found to cause relapse of edema.

Many patients have complained of cough, with a white frothy sputum. The presence of edema of the lungs has been suggested.

6. *Heart-Blood Changes.*—West Holland reports indicate that the heart may be normal, often with a slow pulse rate down to 40 per min., and with a systolic blood pressure down to 80 mm Hg. Studies in Kwangtung indicated that the heart is sometimes moderately enlarged and heart sounds diminished in volume and with a tendency to "tick-tack" rhythm; but so few cases were seen with signs of congestive failure that it is assumed that cardiac failure could have little to do with the development of the edema.

Laboratory findings in West Holland indicated that all patients were anemic, hemoglobin concentration usually being about 11 Gm. per 100 cc, with color index about 1 or slightly over. Anemia was frequently severe, in harmony with the degree of starvation. There was a tendency to leucopenia. Studies of malnutrition in Newfoundland indicated a hemoglobin concentration below 12 Gm., sometimes below 11 Gm. Higher values were found in native army camps in India.

(As Kruse has pointed out, a correlation between tissue states and blood or excretion levels is not necessarily to be expected, in fact, is usually not obtained because of numerous factors, dominantly 1) asynchronism and 2) conditioning factors. The blood level change precedes tissue change and occurs more quickly and frequently. It reflects only the more recent dietary intake, whereas tissue change is the last event; it is cumulative and reflects past as well as present deficiency. He cites many examples of conditioning—the development of pellagrous skin lesions on parts exposed to the sun; the effects of exposure to light on corneal vascularization in riboflavin-deficient rats; the influence of irritation in the development of cheilosis, or of the edentulous state in angular stomatitis; of malocclusion or acute infection in the occurrence of gingivitis in vitamin C deficiency. Positive correlation is more likely to be found with acute deficiency states and with younger age groups in chronic states.)

7. *Bone Dystrophies.*—These have been reported from West Holland, in some starvation cases. General osteoporosis was observed, with pain in the bones and a progressive kyphoscoliosis of the upper part of the spine. It was accompanied by marked emaciation. A second group, less emaciated, complained

of pain attributed at first to rheumatic origin. Severe cases radiographically showed translucent areas in the cortical zone of numerous bones, especially the long bones.

8. *Vitamin Deficiency Findings.*—(Exclusive of Mouth and Teeth).

a. In general, vitamin deficiency disease syndromes were not commonly observed; the problem was basically the lack of calories and of protein. The West Holland report indicated that the administration of vitamins, liver extract and iron did not relieve anemia; this condition gradually improved after sufficient feeding. It is to be expected, of course, that in starvation, where vital bodily processes are reduced to a basic minimum, vitamin deficiency disease syndromes would not be conspicuously present.

b. Vitamin A: Reference has been made to starvation influences on growth of children. Low vitamin A values have been reported from several areas. Eye lesions of several types have been described. In West China, normally free of true starvation conditions, a period of civil war, when communities were cut off from adequate supplies of green vegetables, resulted in increase of keratomalacia, especially amongst children. These cases, when not caught in time, went on to blindness, due to large ulceration of corneae, with prolapse of intraocular content plus secondary infection. In addition to xerophthalmia and night-blindness, lesions of the skin-phrynoderma, with xerosis, roughness, papular eruption about pilosebaceous follicles, and follicular keratosis in severe cases.

c. Vitamin B Complex: It is often difficult to diagnose lesions in relation to isolated elements of the B-complex, since deficiencies are usually multiple.

(a^1). Thiamine. Beri-beri has been reported from Szechwan and Kwangtung; also in Greece, but not in high incidence. Among edematous cases in Kwangtung nervous symptoms were not common. Numbness in feet or legs was attributed to the altered sensation following stretching of the skin by edema. In West Holland, administration of thiamine was not found to influence edema. Newfoundland studies indicated very little beri-beri but fundamental disturbances of central and autonomic nervous systems were attributed to lack of thiamine. The "Newfoundland stomach"—constipation irritability, dyspepsia, itching, burning sensations and lassitude—was susceptible of immediate relief with the administration of thiamine.

Three types of beri-beri have been described—a "dry" type, with a dominant multiple neuritis; a "wet" type, with edema and serous effusion without heart failure; a cardiac type with circulatory failure. (See also under Mouth Lesions.)

(b^1). Riboflavin. Deficiency of riboflavin has been reported especially from Szechwan; also common in Newfoundland, India and Germany, and among Manitoba Indians. Lesions include vascularization of the cornea; hyperemia of scleral conjunctiva, photophobia, blepharitis and folliculosis (elevated follicular plugs across nose and cheeks.) (See also under Mouth Lesions.)

(c^1) Niacin. Evidences of the classic picture of pellagra have not been found in the starvation studies with which the writer is familiar. Observers from Szechwan have noted, however, milder evidences of similar lesions.

d. Vitamin C. A true scurvy was very seldom observed, although mouth lesions of a pre-scorbutic or scorbutic nature were observed with some frequency. It was found in West Holland that ascorbic acid did not influence the petechial hemorrhages; these slowly disappeared under general treatment.

My studies in Eastern Tibet have indicated a widespread vitamin C deficiency, but again not extensive scurvy. Reports which I secured from representatives of remote Tibetan ethnic groups included description of the classic systemic picture of scurvy. (Empirical treatment has long been the procuring and drinking of the raw juice of a scarce type of turnip.)

Cunningham suggests that lack of this vitamin may be related to intraocular hemorrhages.

e. Vitamin D. Reference has been made to the bone dystrophies reported from West Holland, which responded well from injections of D_3. Those with generalized osteoporosis responded more slowly than those with focal decalcification. Schour has reported the prevalence of rickets in Italy, where he observed that children commonly stayed out of the sun. Rickets is rare in South and West China, but occurs, in both juvenile and adult form, in North China. Rickets has been reported from Holland and rickets and osteomalacia from Northern India.

f. Mouth Lesions in Starvation or Marked Deficiency Conditions.

(a^1) Dental Caries. Several observers have reported studies indicating no increase in the incidence of dental caries under starvation or near-starvation conditions. F. C. Cady of U. S. Public Health Service examined the teeth of 495 Dutch children, aged 7-15 years, who had survived five years on a diet of tulip bulbs, grass and occasional vegetables permitted them by the Nazis. The children were under weight, stunted, rachitic, and tubercular in some cases. However their teeth had, in his opinion, suffered very little. He reported that DMF ratings were only "half as bad" as those of children of similar ages in New Jersey, examined in 1944. Their increase in decayed surfaces was at the rate of one-sixth cavity per year. He considers that the complete absence of sugar and sweet foods, and the availability of only the coarsest of grain products kept the hazardous elements out of their meagre diet; he also feels that fluorine may have had some bearing on their immunity.

Isaac Schour, in a preliminary report on his study of conditions in Italy states that, at the Eastman Dental Clinic in Rome, Italians showed less caries than usual, and a concurrent increase in periodontal disease.

Dean, from an examination of 2000 Germans and Lithuanians, reports findings similar to those of Schour.

Schourie studied dental caries in children in Madras, India, in relation to economic and nutritional status. With a general percentage of caries-immunes

in the Madras study of 39.8 per cent he found no difference in susceptibility between children with established deficiency disease and normally nourished children; further, he found no relation to the economic status of the family concerned.

Similar findings are reported from Northern India by C. D. M. Day.

Kohn, on the other hand, found, in a study of a student population in Chengtu, including many refugee students from coastal China a higher incidence of dental caries than had been found prior to the Sino-Japanese war in a corresponding body of students. This is interesting, especially in view of the fact that consumption of refined sugars had dropped considerably due to absolute shortage, extreme inflation conditions, and other factors.

Severe dental caries is reported from Newfoundland, but with no comparative data, contrasting nutritional states in this connection.

It would seem the part of wisdom, in view of the nature and the limitations of available data to defer dogmatic judgment as to the effects of starvation and near-starvation diets on the production of dental caries. Considerable evidence suggests that the limitation of sugar intake exerts a controlling influence upon caries development. However, the evidence in this connection is not in full agreement, and further data will be required. Proponents of the fatty-acid-hypothesis of Box, emphasizing the desquamated epithelium of the mouth as a source of the protective fatty acids will need to know how this source is affected by dietary deprivation. New concepts of impregnation processes in the enamel in relation to caries immunity demand the clarification of unexplored areas in mouth chemistry—of fluorine studies; of silver impregnation (Gottlieb) and other theories.

(b^1) Oral Tissues Gingivae and Periodontal Bone. As already mentioned, it is not to be expected that marked evidences of vitamin deficiencies would be found in extreme nutritional states. The general effects of starvation reduce the body to a minimally active state—a relative hibernation. Since, in children, growth usually is checked in severe cases, the demand for vitamin levels is greatly lowered. Exceptions would occur in instances where skeletal growth continues even under starvation conditions.

(1^1) Vitamin-A Deficiency.—No lesions of the hard or soft tissues, suggestive of vitamin-A deficiency have been, in the surveys available, associated with starvation states.

(2^1) Vitamin-B Complex.—*Thiamine* deficiency in the mouth (increased sensitivity of oral tissues, herpetic or aphthous lesions) have been reported in a few instances.

Riboflavin deficiency, as evidenced in the mouth in conditions of marked food deprivation, has been observed with frequency in Europe, Asia and Africa. Lesions such as magenta-colored glossitis, cheilosis, angular stomatitis, seborrheic dermatitis of nasolabial folds, alae nasi, eyelids and ears, occurred singly or in combination.

Similarly, many reports from Europe and Asia indicate the observation

of signs of *niacin* deficiency—typical, fiery-red glossitis, glossodynia swollen, tender tongue, injected oral mucosa, stomatitis, gingivitis, (frequently ulcerative), "pellagra sine pellagra," weakness, lassitude, insomnia, anorexia, weight loss, etc.

(3^1). Vitamin-C.—As stated in connection with general symptoms of vitamin-C deficiency, a true acute scurvy is infrequently seen; but milder evidences are very commonly reported in connection with deprivation states—mild, acute and mild chronic lesions; and, in some instances severe chronic lesions are described. Whether or not the cases reported of advanced disease with rarefaction and loss of alveolar bone followed by loosening and loss of the teeth may be accurately attributed to advanced C-deficiency involves a discussion not pertinent to this presentation. Kruse has described, in minute detail, the earliest as well as later changes which he attributes to this type of deficiency. It would seem that perhaps the clinical picture presented, especially in the early stages, is not strictly characteristic of Vitamin-C deficiency, but represents, frequently, inflammatory changes of a non-specific nature doubtless initiated by vitamin-C deficiency.

(4^1) Mineral Deficiencies in Relation to Periodontal Disease.—Available information from areas of starvation or near starvation in this connection is still too scanty to warrant inclusion or to justify deductions. While observers refer to the loosening and elimination of teeth from the jaws of starving individuals implying profound changes in cementum, bone and periodontal membrane, the pathological processes and sequences involved remain to be determined.

(5^1) Cancrum Oris (Noma)—This extremely dangerous disease, a rapidly progressive gangrene of the oral and facial tissues, is almost unknown, under peacetime conditions, in the Western world; but it is regularly observed—fortunately not in large numbers of cases—in areas of dense population and narrow economic margin, such as China. Under war and postwar conditions in that country cancrum oris has been encountered with greater frequency. It has also been reported from the Belsen concentration camp. It is never a primary disease, but there is in practically every case a background of malnutrition. In addition there is, almost invariably, a concurrent debilitating disease; or else the patient is suffering from the after effects of such disease—smallpox, measles, typhus, kala azar, tuberculosis. In some cases famine edema is present when the gangrenous disease commences. As Dawson points out, the effect of the gangrenous lesion is to produce a vicious circle, in that the malnutrition predisposes to cancrum oris and the lesion itself tends to prevent the patient from taking nourishment by mouth. From my observations the progress of the disease, if untreated, is extremely rapid; and within perhaps ten days from the original inception of the gangrenous attack on the buccal mucosa or in stagnation areas about the teeth, the patient dies of toxemia or of aspiration broncho-pneumonia. With sufficiently early treat-

ment, consisting of prompt and vigorous nutritional care, surgical removal of necrotic tissue and appropriate bactericidal procedures, a high percentage of cures may be secured.

(6^1) Response to Treatment.—Kwangtung studies differentiate two groups —a) in which there followed a rapid uncomplicated recovery; b) in which there was a generally persistent albuminuria, progress was slow and laborious, with disappointing relapses and a tendency to die suddenly and unexpectedly. West Holland reported that, in the early relief campaign phase, 10% of admissions to hospital died, but pointed out that mostly older age groups and complications were admitted to hospital. In this latter study, three types of death were recorded—a) sudden, unexplained, early after admission to hospital; b) unexpected, after patient appeared on way to recovery, a turn for the worse leading to death in about one hour; c) slow death, patient lapsing into coma, as in any exhausting disease.

(7^1) Autopsy Findings.—Data here is scant. Broncho-pneumonia was found commonly, in both lower lobes. Some showed atrophy of liver, heart and spleen.

CONCLUSION

For reasons above stated, this study of the effects of starvation and near-starvation diets is of necessity a preliminary one to be followed with more statistical data at a later time. It is hoped that in those troubled parts of the world where nutritional deprivation is causing such tragic loss of life and such widespread suffering and distress, efforts will be made to secure full scientific information leading to further knowledge of bodily processes in general and specialized fields. From the humanitarian and international aspects it is obvious that the peoples of areas favored to an unusual degree by nature and by circumstance, as in America, should attack this global problem with such earnestness and willingness to share that the resources of the world may truly become available to all mankind.

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Penicillin as an Oral Therapeutic Agent*

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PENICILLIN at present is the best known and most widely used of the antibiotic agents. During the past few years it has enjoyed an extremely prominent place in medical and lay literature and has rightfully been given the credit for saving many lives and relieving much pain and suffering. The discovery of its beneficial effects followed closely the discovery of the wonders of the sulfonamides. Penicillin therapy has been found effective in many instances where the sulfas have failed and yet like its predecessor it possesses limitations. When first used it was thought to have practically no toxic effects upon the subject being treated. However, as experience with the drug widened, certain toxic reactions, which will be enumerated later, developed in a limited number of cases. Furthermore, not all microörganisms are susceptible to penicillin therapy.

Efforts have been made to ascertain the various forms of bacteria which are susceptible to the action of penicillin. Based on present knowledge gained from *in vitro* and *in vivo* studies there are about twenty-five susceptible and twenty-six non-susceptible organisms (1). Generally speaking, the gram positive bacteria, gram negative cocci, and certain spirochetes are susceptible. This includes bacteria often found in cases of oral sepsis such as, Staphlococcus aureus and albus, streptococci of various types, pneumococci, streptobacilli, spirilla, spirochetes, and streptothrix. It must, however, be realized that different strains

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of a single organism may vary considerably in susceptibility. It is worthy of note that penicillin seems to afford no protection whatever against gram negative bacilli and most viruses.

The manner in which penicillin acts upon the various susceptible organisms is not yet fully understood. However, many investigators have presented evidence that the drug may act as a bacteriostatic agent and under certain conditions it may even act as a bactericidal agent. In connection with studies on the action of penicillin, Heilman and Herrell (2) have reported observations which suggest that considerable time is necessary for penicillin to act on certain bacteria. They state that subcultures of preparations containing bacteria and penicillin made at various intervals indicate that the period for complete inhibition of bacteria varies from four to six hours. This fact must be kept in mind when considering the use of penicillin as a local treatment agent. If satisfactory results are to be obtained conditions must be favorable to the maintenance of penicillin in adequate concentrations at the site of infection. This fact will be discussed in more detail when dosage forms are considered. It is of interest to the dentist that the action of penicillin, unlike that of the sulfonamides, is effective in the presence of pus, para-aminobenzoic acid, or solutions of the commonly used local anesthetics. Certain bacteria contain penicillinase, an enzyme which destroys penicillin, however, some bacteria which form penicillinase are still susceptible to the drug, while others which do not produce it may not be susceptible (3).

In dentistry as in medicine there is a wide variety of penicillin dosage forms in common use. Parenteral administration may be by intravenous, intramuscular or subcutaneous injection. Although these methods are nearly equal in effectiveness the intra-muscular injection is most commonly used, because of its relative freedom from pain in comparison with the subcutaneous method. Furthermore, it does not require complete hospitalization as does the intravenous continuous drop method. When the aqueous solutions are used with the intramuscular method, injections may be made at three hour intervals, while if the oil solutions are used, satisfactory blood levels may be maintained for an eight or ten hour period.

More recently the oral administration of penicillin has been made possible providing a satisfactory buffer accompanies the drug. The buffer action is necessary to neutralize the acids of the stomach which would normally inactivate the penicillin. By this means the penicillin can reach the small intestine where it is effectively absorbed by the blood stream, thus building a satisfactory blood level to be carried to the site of infection.

Many methods for the local application of penicillin to oral lesions have been advocated. Among these are the application of aqueous solutions of penicillin as a spray, an irrigation or a wet pack, the topical application of concentrated solutions of penicillin and spraying of anhydrous penicillin powder. MacGregor and Long (4) of England reported the use of gelatine pastilles, containing penicillin, in the treatment of acute ulcerative gingivo-stomatitis.

The incorporation of penicillin in an oil base ointment has also been employed,

especially in those cases where the instillation of penicillin into an enclosed pocket or cavity seemed indicated. As previously stated the effect of penicillin is impaired by its short duration of action unless constant contact with the drug is maintained, necessitating frequent application when solutions are employed. In treating many of the common oral infections the value of a dosage form which will maintain a bacteriostatic concentration of penicillin at the site of infection, can readily be seen. This is especially true when we consider the possibility of the development of a penicillin-fast strain of organisms. With these thoughts in mind the lozenge or troche containing penicillin was developed. Other advantages of the lozenge are the simplicity of administration and increased length of dissolving time. These features are a distinct advantage for continuous medication during sleeping hours.

When penicillin became available for civilian use in April, 1945, a series of experiments were undertaken at the University of California, College of Dentistry to determine the value of the drug in the treatment of oral lesions. Because of the previously stated advantages, the lozenge was the dosage form of choice. James P. Jones and Leonard K. Chan (5) of the University of California Pharmacy developed a penicillin lozenge for use in these experiments.

The qualifications to be met by the preparation were:

1. It should be easily produced in large quantities.
2. It should have maximum stability with a minimum of moisture content.
3. It should dissolve slowly and give sufficient saliva concentration of penicillin to be clinically effective.
4. It should contain no ingredients harmful to the subject or deleterious to the action of penicillin.

The hard tablet developed is one-half inch in diameter, one-eighth inch in thickness and weighs seven and one-half grains. The following formula was used in compounding the tablet:

Acacia powder	60%
Sucrose powder	25%
Calcium stearate	15%
Penicillin sodium q.s.	1000 units per troche

To lessen friability this formula has since been altered, substituting lactose powder 37% for sucrose, and stearic acid 3% for calcium stearate. The penicillin used in this tablet may be either the sodium salt or calcium salt of penicillin. There are certain notable differences however, in the sodium and calcium preparations. The stability of the penicillin depends mainly on two factors, namely, the freedom from moisture and the storage temperature. Due to the hygroscopic properties of the sodium salt of penicillin it has a much shorter shelf life than that of the comparatively non-hygroscopic penicillin calcium. On the other hand experiments proved that fewer toxic reactions were noted following therapy with penicillin sodium than those with penicillin calcium. A detailed discussion of the reactions has been published (6).

Tests run on penicillin sodium lozenges made up according to the original formula revealed the following:

1. The tablet contained about 6% moisture.
2. The tablet lost no appreciable potency during the first two weeks if stored under refrigeration.
3. The tablet lost 50% of its potency if refrigerated for sixty days.
4. There was a 50% loss of potency after three weeks at room temperature.
5. Assays indicated that salivary concentrations of penicillin could be maintained at from 2 to 4 units per c.c. of saliva. This is considered a highly satisfactory concentration when we compare it with the blood levels in systemic therapy, which range from 0.01 to 0.5 units per c.c. of blood.

Also it is eight to sixteen times the concentration necessary to render the Reiter, Kozan, Nichols, and Noguchi strains of Spirochaeta pallida and a mouth spirochete non viable *in vitro* (7). It is thirteen to twenty-six times the concentration of 0.15 units per c.c. needed for a maximum bactericidal effect against staphlococcus and hemolytic streptococcus *in vivo* (8). On the basis of these facts a troche or lozenge containing originally 1000 units of penicillin should be clinically effective even after fifty per cent decrease in potency during a two month storage period. Therefore, the lozenges made according to the above-mentioned formula were considered satisfactory for preliminary clinical investigations. By the time some of the pharmaceutical houses were ready to manufacture penicillin troches the Federal Food, Drug and Cosmetic Act was ammended. They required 500 or 1000 unit penicillin troches to have an effective concentration after nine months, a moisture content of less than one per cent and the preparation to be stored at temperatures not above fifteen degrees centigrade. This necessitated certain changes in the formulae of the marketable lozenges. It was found that by using the calcium salt of penicillin these requirements could be fulfilled. Because of these specifications it is probable that the pharmaceutical houses manufacturing penicillin troches are using the calcium penicillin.

Experience has shown that the lozenge will require from one to five hours to dissolve when allowed to remain in the buccal fold undisturbed. The average time is two and one-half hours. This latter time seems to be the most desirable for dissolution since it maintains an adequate concentration of penicillin without causing the inconvenience of constant replacement. Patients should be instructed to insert a lozenge in the buccal fold, between the gums and the cheek, allowing it to remain stationary thereby permitting slow dissolution. After dissolution, lozenges are to be replaced, alternating sides. To obtain complete coöperation, patients should be advised that maximum results are obtainable only through constant liberation of the drug. Patients should also be cautioned that the reserve supply of lozenges should be kept refrigerated (9).

The results obtained through the therapeutic application of the penicillin lozenge in the oral cavity proved highly satisfactory in the presence of penicillin susceptible organisms. Case histories to be presented later are illustrative of the beneficial results obtained. In spite of the fact that these results were often spectacular in nature, it must be emphasized that penicillin should rarely be considered the only form of treatment required in the elimination of oral lesions, since, unless the etiologic factors are removed, the effect of penicillin may prove temporary in nature. Penicillin therefore should be considered only as an adjunct to treatment, also it may be used as a prophylactic agent in the prevention of unfavorable sequelae to surgical procedures.

Clinical experience has shown that there is a considerable number of indications for the use of penicillin in dentistry. In considering these indications it is well to remember the part played by inflammation in the presence of oral lesions whether they be acute, subacute, or chronic in nature. Inflammation may be looked upon as a reaction to tissue cell injury. It may be due to mechanical injury, chemical injury, bacterial injury or injury from bacterial toxins. Whether the inflammation is directly due to bacterial action or whether bacteria are only secondary invaders, their presence in the oral cavity must always be reckoned with. Frequently, if the bacterial count is diminished or eliminated, inflammation will materially subside even though complete healing of the injury has not yet taken place. This is evidenced by the fact that if penicillin is used following surgical procedures involving the soft tissues of the mouth, healing is rapid, practically painless and not accompanied by over granulation of the wound surfaces.

In treating diseases of dental origin which require parenteral use of the drug, coöperation with the medical practitioner is advised. Because of its quick and effective action and its almost complete lack of toxicity it should be used in preference to other agents in all infections produced by penicillin susceptible organisms. The systemic use of penicillin is suggested in the treatment of cellulitis of the face and jaws, in osteomyelitis of the jaws, in Ludwig's angina and in sinus thrombosis resulting from dental infection. It may likewise be used as a prophylactic measure against bacterial endocarditis in cases where infected teeth must be removed from a patient having a known heart lesion or as a specific treatment for bacterial endocarditis which develops following removal of an infected tooth.

Dosage varies considerably in the treatment of these conditions. However, for severe infections penicillin may be given intra-muscularly in doses from 30,000 to 50,000 units every three hours. In milder infections dosage may be reduced to 20,000 units every three hours. It is generally believed however, that the safest procedure is to give a sufficiently high dosage that no penicillin resistant strains of microörganisms will be developed.

Toxic reactions to systemic administration of the drug, though sometimes alarming in appearance, are rarely serious in nature. If these reactions are observed, discontinuance of therapy is indicated unless the patient's life because of the infection is in danger. Herrell (10) lists these toxic symptoms

as: Pain at the site of local injection, chills and fever, urticaria, dermatitis, abdominal pain and occasionally exfoliative lesions.

The local application of penicillin has proved valuable in varied types of oral lesions. Wright and Rule (11) reported its successful use in the treatment of ulcerative gingivitis and stomatitis, Vincent's angina, gingival hypertrophies of bacterial origin, pregnancy gingivitis, aphthous stomatitis, pericoronitis, and inflammatory types of periodontosis. Gwinn, *et al* (12) reported successes in the treatment of pericoronitis and Vincent's type infections. In all of these lesions, for reasons previously mentioned, the dosage form of choice is the lozenge or troche, although in severe cases of Vincent's angina or pericoronitis cases with extensive cellulitis it is well to use both local and systemic applications of penicillin. Its local application is also effective in treating acute periodontal abscesses, deep periodontal pockets and cystic cavities. In such cases however, the drug should be instilled into the cavity or pocket in the form of an ointment containing 1000 units per gram or in saline solution containing from 1000 to 5000 units per cubic centimeter. Again emphasis is placed upon the fact that penicillin therapy alone is rarely sufficient but should be used in conjunction with other indicated measures.

Gwinn and Grimm (13) have carried on clinical investigations in the use of penicillin lozenges following the extraction of impacted third molars and other particularly difficult cases. They divided their cases into four groups. One group was given postoperative treatment with both penicillin and sulfathiazole. Other groups were treated with sulfathiazole alone or with penicillin alone. In handling the final or control group, neither penicillin nor sulfathiazole were used. Observations were made on a total of three hundred and eleven cases. A summary of the work indicates that when penicillin and sulfathiazole were used together the best results were obtained. Sulfathiazole without penicillin gave better results than penicillin when used without sulfathiazole. Penicillin when used separately gave better results than when neither were used. They concluded that penicillin lozenges were not indicated for routine postoperative treatment in the type of cases investigated. However, where there has been any history of Vincent's infection, or where due to the condition of the oral mucosa it is thought that the possibility of infection has been increased, the use of penicillin lozenges in addition to the use of sulfathiazole would seem to be indicated. In their investigations no local disturbances were noted which would contra-indicate the use of penicillin.

Wright and Rule (14) however, have observed toxic symptoms in a limited number of cases incident to the use of penicillin lozenges in the treatment of oral infections. The type of reaction varies with different individuals and also with the salt of penicillin used. In the case of sodium penicillin, reactions which developed were mild and of short duration. They consisted of glossitis, papules on the tongue and soft palate, sore throat, slight nausea and stomatitis. Reactions developing from the use of calcium penicillin were of a more severe nature, of longer duration and greater frequency. Symptoms have been observed, such as, soreness of the throat and tongue, extreme dryness of the

lips, burning sensation throughout the mouth, impaired taste, sensitivity to hot foods, exfoliative lesions and fissures at the corners of the mouth. In view of these findings we feel it is important to exercise caution when individuals sensitive to penicillin are encountered and when possible the use of the sodium salt of penicillin should be used in compounding the lozenges. In spite of the fact that reactions may occur, the margin of safety is so great and the beneficial results so outstanding, that the local application of penicillin is to be recommended in conditions responding to penicillin therapy. In most instances where reactions developed it was noted that the acute symptoms of disease had already been brought under control before toxic symptoms occurred.

CASE REPORTS

CASE 1

Patient: Male, age 32. Engineer.

Complaint: Pain and swelling around the lower left third molar and swelling in the cheek.

History: The above symptoms started three days previous to patient's presentation for treatment.

Examination: Intra-oral examination revealed a heavy flap of gingival tissue over the major portion of the occlusal surface of the left mandibular third molar. There was a considerable amount of hypertrophy and hyperemia present with some evidence of a beginning cellulitis. The submaxillary gland was painful to touch and the cervical lymph nodes were swollen.

Diagnosis: Pericoronitis about the lower left third molar.

Treatment: The area beneath the gingival flap was irrigated with a five per cent solution of urea peroxide. Penicillin lozenges were prescribed. The patient returned daily for three days. Each day the involved area was irrigated with urea peroxide 5 per cent. On the third day there was no clinical evidence of infection present. Therapy was discontinued and the patient instructed to return in one week if symptoms did not reappear. The tooth was then removed and the patient again instructed to use penicillin lozenges for a forty-eight hour period. Healing was uneventful.

CASE 2

Patient: Female, age 15. Student.

Complaint: Painful ulcers in the mouth.

History: Over a period of four years ulcers of a similar nature had occurred intermittently. There was no regularity in occurrence, however the patient had not experienced freedom from them for a period longer than two months. Previous treatments had consisted only in local applications of caustics to the ulcers. The usual duration of the ulcers was from four to ten days.

Examination: Five ulcers were present in the mouth, all to the left of the median line. Two were on the buccal mucosa, two in the lower buccal fold and one on the buccal gingiva. They appeared as yellowish white spots, somewhat oval in shape, the largest being approximately 2 mm. by 3 mm. in size. All were painful to touch or movement of the facial muscles.

Diagnosis: Habitual aphthosis or aphthous stomatitis.

Treatment: Penicillin lozenges were prescribed and the patient was placed on a therapeutic intake of vitamins A, B complex, and C. The pain was reported relieved in four hours. The ulcers appeared healed in forty-eight hours. Penicillin therapy was then discontinued. The vitamin therapy was continued for a thirty day period at which time the patient was instructed to drop to a maintenance dosage.

Epicrisis: There has been no recurrence of ulcers over an eight month period.

CASE 3

Patient: Female, age 62. Housewife.

Complaint: The patient complained of severe pain about and looseness of the upper left first bicuspid.

History: One week previously the tooth had become sore to pressure under the stress

of mastication. Several days later swelling of the soft tissue around the tooth was noted. By the fifth day the pain had become constant and the swelling had spread to the lip and cheek.

Examination: The left maxillary first bicuspid was extremely mobile. Much hyperemia of the surrounding gingival tissue was evident. No break in the periodontal attachment was detected on the mesial, buccal or distal. There was evidence of a narrow, deep pocket along the lingual root surface which required some pressure for entry. Pointing of the infection was observed buccal to the apex.

Diagnosis: Acute periodontal abscess.

Treatment: The lingual pocket was opened and the root surface carefully curetted. Some drainage was noted at this time. The buccal soft tissue was punctured at the area of pointing. Penicillin ointment containing 1000 units of penicillin per gram, was forced into the lingual pocket until there was evidence of its coming through the buccal opening. Penicillin lozenges were prescribed for home use and the patient instructed to return the following morning. At that time the patient reported almost complete relief from pain and the swelling was greatly reduced. Penicillin ointment was again instilled into the lingual opening following a mild curettement of the pocket. No further treatment was instigated.

Epicrisis: The patient was seen three months later. The tooth was firm. No evidence of the buccal sinus existed and the lingual tissues appeared firmly attached.

CASE 4

Patient: Male, age 26. Medical student.

Complaint: Sore, bleeding gums.

History: The patient reported that five months previously he had been treated for an ulcerative gingivitis which had developed simultaneously with a pericoronitis of the right mandibular third molar. Acute symptoms had been reduced and the third molar was removed. Healing was uneventful. During the succeeding five months, three distinct flare-ups of the ulcerative gingivitis occurred.

Examination: Gingivæ in the anterior portion of mouth appeared normal. Between the posterior teeth many of the interdental papillæ had been lost. The tissues appeared inflamed and denuded of epithelium. There were no visible ulcers present, although the tissues were sensitive to touch.

Diagnosis: Chronic ulcerative gingivitis.

Treatment: Penicillin lozenges were prescribed. The patient returned seven days later. The tissues were no longer sensitive. Hyperemia had decreased. Examination one week later showed no evidence of inflammation. Cupped areas in the posterior interproximal gingival tissues appeared to be leveling. The patient reported that his mouth was entirely comfortable and that bleeding had ceased.

Epicrisis: During the following six months the patient reported no further flare-ups and the examination revealed no further tissue loss.

CASE 5

Patient: Female, age 41. Stockroom clerk.

Complaint: Swollen and severely bleeding gums.

History: The patient had noticed intermittent bleeding of the gingivæ during the past five years. Bleeding was less severe immediately following mouth hygiene by her dentist. An increase in night bleeding had been observed during the past year.

Examination: Supragingival calculus was excessive, subgingival deposits were slight, and light trauma produced hemorrhage. Tissues were hyperemic and hypertrophied.

Diagnosis: Hypertrophic gingivitis.

Treatment: Penicillin lozenges were prescribed. On the third day of treatment the patient reported that night bleeding had stopped although gingival tissues still bled when brushed. On the seventh day of treatment gingival tissues appeared normal in color and the hypertrophies were materially reduced. Brushing no longer produced gingival hemorrhage. Following the initial period of penicillin therapy the deposits of calculus were removed. The patient was instructed in proper home care and was placed on multivitamin therapy. During the following nine months the case has been observed

at three month intervals. No further treatment was indicated with the exception of routine mouth hygiene procedures.

CASE 6

Patient: Male, age 38. Consular Service.

Complaint: Unpleasant taste. Painful bleeding gums.

History: The patient had been treated twice during the past three years for ulcerative gingivitis. Following treatment, the acute symptoms subsided. Tissue loss about the anterior teeth continued. The treatment had consisted of local application of caustics, removal of surface deposits and the use of oxidizing mouth washes for home care.

Examination: The gingival tissues were approximately normal in height around the posterior teeth and approximately one-third of the roots of the anterior teeth were exposed due to recession of the gingival tissues. Pockets throughout the mouth ranged from three to six mm. in depth. Deposits of calculus were moderate. Stains were heavy, especially on the anterior teeth.

Diagnosis: Periodontosis (inflammatory).

Treatment: Penicillin lozenges were prescribed. On the fourth day the patient reported that his mouth was comfortable and that bleeding had ceased. The patient was instructed to continue the penicillin treatment. On the sixth day a black coating appeared over the tongue. The patient was instructed to discontinue use of the penicillin lozenges. On the thirteenth day the tongue appeared normal. Subsequent to penicillin therapy, subgingival curettage was employed in all periodontal pockets, stains were removed, and the patient given instruction in home care.

Epicrisis: During the following six months no recurrence of the original symptoms were noted and the tissues continued to appear normal.

CASE 7

Patient: Female, age 35. Housewife.

Complaint: Extremely sore, bleeding gums and sore throat.

History: The above-mentioned symptoms had their onset five months previously. A dentist diagnosed the condition as Vincent's infection. Treatment included the use of oxidizing agents, analine dyes, prophylaxis and, as the acute symptoms partially subsided, subgingival curettage was employed. Tissue response was moderate, soreness of the throat continued, and some ulcerated areas remained on the interproximal tissues. On occasions when the patient overindulged in the use of tobacco and alcoholic beverages the original acute symptoms returned. The application of caustics was without favorable results.

Examination: Gingival tissues appeared generally red and inflamed but shaded to a bluish tone toward the crest of the gingivæ. Much of the interdental tissue had been lost, leaving deeply cupped areas between the buccal and lingual gingivæ. Ulcers were present in many of these cupped areas. The tissue was sensitive to touch and bled freely. Slight deposits of supragingival calculus were noted on the lower anterior teeth. No subgingival deposits were present. The teeth were badly stained due to excessive use of tobacco. Materia alba was present interproximally on all teeth.

Diagnosis: Ulcerative gingivitis.

Treatment: Penicillin lozenges were prescribed. No attempts were made to correct diet, smoking, or drinking habits. On the third day of treatment gingivæ appeared less inflamed and were less sensitive to touch. The throat remained sore and dry. Penicillin treatment was continued. On the seventh day of treatment all ulcers had completely disappeared, the throat felt normal, tissues appeared normal in color, hypersensitiveness of the tissues had disappeared and bleeding had subsided. Penicillin therapy was discontinued on the eighth day. Mouth hygiene procedures were then instituted.

Epicrisis: The patient's mouth has been examined at three month intervals following discontinuance of treatment. There has been no evidence of the return of originally existing symptoms.

CASE 8

Patient: Female, age 40. Housewife.

Complaint: Occasional soreness of gums in the posterior portion of the mouth.

History: The patient has been under treatment for periodontal disease during the last ten years.

Examination: The periodontal pockets were confined to the molars. The root bifurcations of the right mandibular molars were involved.

Diagnosis: Combined type periodontosis.

Treatment: All periodontal pockets were curetted. Two weeks later a gingivectomy involving the right mandibular molars was performed. The usual procedure of employing a surgical pack post-operatively was dispensed with. Penicillin lozenges were prescribed as a prophylactic measure.

Epicrisis: The patient experienced no discomfort during the healing process. The wound healed with unusual rapidity and was free from over-granulation.

CASE 9

Patient: Female, age 36. Office clerk.

History: The patient recently was informed by her dentist that she had an advanced periodontal condition that required special treatment.

Examination: There was a considerable amount of alveolar bone resorption involving the entire mouth. The periodontal pockets about the mesial, distal, and buccal aspects, including the bifurcation of the lower right second molar were extensive.

Diagnosis: Local type periodontosis.

Treatment: Subgingival curettage was employed in all periodontal pockets. Subsequently a gingivectomy of the areas about the lower right second molar was performed. Instead of the customary procedure of employing a post-operative surgical pack, penicillin lozenges were prescribed. The wound remained clean, smooth-surfaced and remarkably free from the usual signs of inflammation. Healing was rapid and without perceptible tissue regrowth. There was no post-operative discomfort. Lozenges were discontinued on the seventh day.

SUMMARY

Investigators have shown that the number of penicillin susceptible organisms are about equal to the number of non-susceptible organisms. Many of the susceptible organisms are those associated with oral lesions. The mode of action of penicillin may be either bacteriostatic or bactericidal. For satisfactory results in penicillin therapy a constant therapeutic concentration of the drug must be maintained at the site of the infection either through the blood stream or by local application. The most satisfactory form of parenteral administration is generally by intramuscular injection. The method of choice for intra-oral local application is generally by means of the penicillin lozenge, the exceptions being those cases which require instillation of penicillin directly into an enclosed cavity or pocket.

The indications for systemic therapy are deep seated or diffuse infections of dental origin which are caused by penicillin susceptible organisms. Local oral application is indicated in mouth lesions where the penicillin may be brought into constant contact with the infection. The elimination of inflammation in dental infections is of prime importance and to this end penicillin is of much value. It must, however, not be used to the exclusion of other necessary forms of treatment.

Preliminary investigations do not seem to indicate its routine use following extractions. Certain toxic reactions may occur incident to the use of penicillin in both systemic and local use. As far as is known the toxicity of

penicillin in man is comparatively low. From the standpoint of avoidance of unpleasant reactions, the sodium salt of penicillin should be used in compounding lozenges.

CONCLUSION

Penicillin is a highly satisfactory and comparatively safe therapeutic agent for use in preventive and curative dentistry where oral infections must be dealt with, especially in the control of acute lesions.

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Recent Developments in Fusospirochetal and Related Infections[1]

By THEODOR ROSEBURY, D.D.S.[2]

I. THE ROLE OF INFECTION IN VINCENT'S AND RELATED DISEASES.

THE MIXED microörganisms found in the lesions of Vincent's angina and in related diseases of the mouth and other mucous membrane areas include a group of anaerobic forms which induce characteristic suppurative lesions when inoculated subcutaneously or intramuscularly into animals (1). These experimental lesions show such stigmata of clinical Vincent's disease as necrosis or ulceration, the occurrence of a fibrinous exudate or pseudomembrane, a typical foul odor, and the presence of a characteristic microbial flora. Such lesions are serially transmissible by parenteral inoculation of exudate. Serial transmission results in simplification of the initial flora, presumably by eventual elimination of some or all of the non-pathogenic accompanying microörganisms. The final flora consistently includes small closely wound spirochetes, small or intermediate non-motile fusiform bacilli, motile vibrios and streptococci, all anaerobic.

The frequent occurrence of fusopirochetal lesions in man as a result of human bite or other tooth injuries (2) indicates that man, like the guinea pig and the rabbit, is susceptible to parenteral inoculation of these microörganisms. Guinea pigs are not susceptible to inoculation by the peroral route, and rabbits do not develop characteristic disease when inoculated on the intact conjunctiva. Several attempts to transmit infection to man by inoculation on the intact or injured gingival mucous membrane (3) have either failed to produce infection or have yielded only mild and atypical inflammatory responses. Thus in man, as in the guinea pig and the rabbit, typical disease does not result merely from implantation of the causative microörganisms on a mucous membrane.

Vincent's disease of mouth, throat or both frequently occurs simultaneously in groups of persons, particularly under wartime conditions. Such outbreaks have commonly been regarded as epidemics, but no unequivocal evidence for epidemic spread of these diseases is known to exist (4). The concurrence of predisposing conditions such as dietary deficiency or neglect of oral hygiene suggests comparability with outbreaks of scurvy rather than with epidemics of communicable disease. The microbial flora of suppurative periodontoclasia is indistinguishable in its pathogenicity for the guinea pig from the flora of acute Vincent's gingivitis (5); but periodontoclasia is not thought to be communicable and is not regarded as a source of Vincent's infection. Fusospiro-

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[1] Condensed from papers presented at the Sixth Postgraduate Program of the American Academy of Periodontology, W. K. Kellogg Foundation Institute, Ann Arbor, April 29, 1946.

[2] Department of Bacteriology, College of Physicians and Surgeons and School of Dental and Oral Surgery, Columbia University, *New York* 32, *N. Y.*

chetal balanitis and vulvo-vaginitis are now considered not to be venereal diseases (6), although they would seem to provide optimum conditions for transmission by contact. Evidence is accumulating that infection in this whole group of diseases is endogenous in origin: that predisposing agencies which induce tissue damage permit undue proliferation of and invasion by members of the normal mucous membrane flora.

This group of diseases may be regarded as *infective, transmissible* under limited conditions, apparently not *communicable*.[3]

II. PENICILLIN IN THE TREATMENT OF FUSOSPIROCHETAL INFECTIONS.

More than 40 papers have appeared since May, 1944, in which a total of over 1000 cases of fusospirochetal infection, both oral and extra-oral, have been treated with penicillin. A survey of these reports leaves no doubt that penicillin is an effective therapeutic agent for these diseases. According to Fish (7), Fleming was the first to find "that if a pastille containing 500 or 1000 units of penicillin were allowed to dissolve in the buccal sulcus, and if it were replaced when expended for 48 hours, then all penicillin sensitive organisms disappeared from the mouth." Garrod (8) first reported that *in vitro* tests showed nearly all oral microörganisms to be penicillin sensitive; while MacGregor and Long (9) presented the results of clinical trials by Fleming's method. Meanwhile several independent studies were reported (10).

Good results with rare exceptions have been obtained by all routes of administration of penicillin that have been tried. By the intramuscular route dosage levels as low as 10,000 units every 3 hours for one or two days have been used successfully (11). Penicillin tablets or lozenges dissolved in the mouth, usually given continuously by day only, have been employed with good results at dosage levels ranging upward from 4,000 units per day for 3 days (12). Topical application of penicillin in aqueous solution has been found effective when as little as 500 units per ml were used in a single application for 15 minutes (13). When applied topically in oil-emulsion packs, repeated applications and somewhat higher penicillin concentrations have been used (14); but Christensen (15) considered this latter method of application more effective than others. Administration by gingival or submucous injection has also been used successfully but appears inadvisable (16). Ingestion has been tried in only a few cases (10d, 17) and appears to be wasteful but effective with adequate dosage.

The pattern of response to penicillin administration in acute Vincent's infection of mouth or throat has generally been described as dramatic. Relief of subjective symptoms has usually occurred within 24 hours, sometimes in 4 to 6 hours (18). Complete recovery has commonly required from 2 to 9

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[3] The word *infective* is used here to signify only "characterized by infection," without implication of communicability. The word *infectious* should be avoided because of its ambiguity in both scientific and literary usage (e.g., "infectious laughter"). *Transmissible* denotes a capacity for maintenance of the infective agent in successive passages through a susceptible host, usually under experimental conditions (e.g., by injection). All infective diseases are transmissible in this sense. *Communicable* signifies a capacity for maintenance of an infection by natural modes of spread; e.g., by contact, through drinking water or food, via the air-borne route, or by means of arthropod vectors.

days; and in several instances it has been noted that healing continued after therapy had been stopped (10d, 11). Negative smears have been obtained within 48 hours, in some instances in 12 hours (15). Several authors have compared penicillin therapy with treatment by other means and have found penicillin more rapidly or more consistently effective (13, 19). In a few instances penicillin therapy has been compared with and found superior to control treatment by similar means without penicillin (9, 20).

Failure to effect a cure in Vincent's infection of mouth or throat has been reported in a few cases, unfortunately without adequately explanatory detail. The series of 109 cases described by Schuessler, *et al* (19a) included 9 failures distributed among groups that received penicillin by different routes. It is of interest that the incidence of failure was higher in a hospitalized group (6 of 30 cases) than in an ambulatory group (3 of 79 cases) despite higher average dosage in the former. Strickland and Gordon (20b) noted "at least one" failure among 20 cases; and Atkinson (21) stated that 2 of more than 100 cases required scaling in addition to penicillin for cure.

Relapse after complete cure seems to have been fairly common, especially since many authors have presented no follow-up data. MacGregor and Long (19) reported no relapses among 75 cases during 5 months; and Cipes (22) stated that none of 10 cases relapsed during 2 to 5 weeks. Joseph (23) observed no relapses among 51 cases during 22 weeks, compared with a relapse rate of 36.5 per cent by other methods of treatment. On the other hand, Pearce and McDonald (11) stated that several of their 50 cases relapsed, but responded to further penicillin therapy; Strock (20a) reported 22 relapses among 204 cases, occurring in 4 days to 3 months despite dental treatment; and Atkinson (21) recorded one relapse after combined therapy with penicillin and by scaling.

Several toxic reactions to penicillin have been noted, but they have on the whole been both mild and infrequent. Pearce and McDonald (11) reported 2 cases in which a maculopapular eruption occurred and subsided in 24 hours; Stern (16b) noted that one patient developed extra-oral swelling and lymphadenopathy after submucous injection of penicillin, presumably into an infected area; Strock (20a) recorded 1 case of itching on the cheek; and Wright and Rule (24) stated that in 3 instances among 10 cases treated with penicillin lozenges sore throat developed, accompanied by papules on soft palate and cheek. In a more recent report the latter authors (25) recorded 13 instances of toxic reactions among 151 patients treated with sodium penicillin lozenges (9 per cent) as compared with 6 reactions among 38 cases treated with calcium penicillin lozenges (16 per cent). In the former group, moreover, the symptoms were mild and persisted for 1 to 6 days; whereas with calcium penicillin the symptoms were more severe and persisted for as long as 57 days.

Diseases classifiable in the fusospirochetal group which have been treated successfully with penicillin include, in addition to Vincent's gingivitis, stomatitis and pharyngitis: periodontoclasia (13); pericoronitis (13, 16, 19b, 20b); various gingivitides (13, 12); tropical ulcer (10b, 26); lung abscess (10a, 27);

human bite infections (10e); noma (28); fusospirochetal balanitis (18); and agranulocytosis (29).

Although in many instances penicillin therapy has been used successfully without adjuvant measures, particularly in certain extra-oral infections (18, 23), most authors agree that complete cure may require additional treatment for the elimination or control of predisposing causes. Penicillin is unlikely to do more than abolish the infective phase of these diseases. Infection appears to be only one phase of the etiology of these diseases, with non-infective factors probably differing both in kind and in relative importance from one clinical entity to another. The dramatic effectiveness of penicillin in abolishing infection and its immediate sequels in both oral and extra-oral fusospirochetal disease supports the view that infection is an essential factor in their causation. These findings, on the other hand, need not be considered as minimizing the importance of factors other than infection. Cure of periodontoclasia or noma is hardly to be expected by the use of penicillin alone. Until the whole picture of the etiology of these diseases becomes clearer, it seems essential that penicillin therapy be accompanied by other measures of treatment. With reference to fusospirochetal diseases of the mouth these measures include the elimination of irritants and other traumatic agencies and, where indicated, nutritional or other constitutional therapy. Since penicillin rapidly controls pain and apparently abolishes the infectivity of the fusospirochetal flora (30), it is recommended that instrumentation and other surgical procedures be delayed for 24 hours or more, during which time penicillin is administered to obtain a satisfactory clinical and bacteriological effect. Additional data are needed to define both optimum dosage and the most satisfactory route of administration of penicillin in the treatment of diseases of the mouth, as well as on the relative toxicity of different penicillin preparations administered by different routes, and on the possibilities of sensitization of the patient or development of fastness in the microörganisms. Present indications, however, are that penicillin is by far the most satisfactory chemical agent for the treatment of fusospirochetal diseases thus far discovered.

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Nutrition and Dental Health

VII. MINERAL AVAILABILITY AND UTILIZATION—SUMMARY OF DIETARY NEEDS AND RECOMMENDATIONS

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FOODS VARY in content of protein, vitamins and minerals not only because of methods of storage, preparation, ripeness and marketing conditions, but also according to species, type of soil, mode of cultivation and geographic origin.

Some soils lack certain substances. Iodine is the traditional example of such lack in the Great Lakes and north central section. Iodized salt is a simple substitute. Other areas lack sufficient iron, calcium, phosphorus or trace substances. Some areas have excesses of sulfur compounds, fluorine or selenium in soil or water in such concentration that products grown are not desirable for their customary purposes. The problems related to these lacks and excesses are of most serious import in their specific locale. Foodstuffs containing excesses or exhibiting lacks which are shipped away from these regions are usually diluted with foods from other places sufficient to offset untoward effects.

AVAILABILITY OF MINERALS

The biologic value of a food is dependent on the availability of its essential nutrients. It is not enough that chemical analysis demonstrate the total protein or mineral present. They must be in forms that the human system can use. In

addition, most essential nutrients require the presence of favorable amounts of other substances for best utilization.

Phosphorus in cereals is present to large extent as phytin or phytic acid, substances not readily broken down in human digestion. This may account in part for the so-called "anti-calcifying effect of cereals," which is possibly instead, an effect attributable to presence of phosphorus that is in unavailable form. Phosphorus from animal sources, meat, milk and eggs, is in available form and therefore such foods are necessary for good nutrition.

Part of the iron in foods is inert. That part that is inorganic and soluble is in a form that can be utilized.

Calcium in milk is probably about 98 per cent available, but if calcium is present in food as an oxalate, it is not utilized by the human being. Spinach has its calcium in this form. Because of this, there has been much adverse publicity as to its value in the diet. Other foods containing significant amounts of oxalate or oxalic acid are Swiss chard, beet tops, lambs quarters and rhubarb.

There is no doubt that oxalates interfere with calcium utilization, but whether this interference leads to a deficiency depends upon both the oxalate and the calcium content of the diet. The loss of calcium by combination with oxalates does not seem to be a serious problem in the majority of American dietaries, since high oxalate containing foods are not consumed regularly enough. Balance studies on children taking one-half cup servings of spinach along with balanced meals showed that storage rates of calcium were not significantly altered (*J. Pediatrics* 12:188, 1938). Its content of calcium oxalate should not bar the use of spinach. It is a rich source of carotene, vitamin K and to a lesser extent, iron; and thus an excellent and valuable food in the dietary.

The lack of calcium in some soils is not of as much practical concern as some publicity would indicate (Neil and Albrecht, *Sat. Eve. Post* 218:14. Sept. 1945). The occasional lowered content of calcium in the foodstuffs grown on such depleted soils could affect only the severely marginal diet in a limited area. Grains, fruits and vegetables are not rich sources of mineral for man. Even if the calcium content of fruits and vegetables grown on calcium-rich soil were as efficiently utilized as that of milk and were eaten as the sole calcium source in the diet, not less than twenty servings of fruit and vegetable would be required to equal the calcium in one pint of milk. This huge quantity would still provide not more than two-thirds of the daily quota of calcium.

In discussion of calcium availability, it should be pointed out that a number of researches have produced evidence that inorganic and organic salts of calcium can be efficiently utilized by man. In common with many pharmaceutic preparations, limitations in their use are in the fact that valuable auxiliary substances are not provided at the same time. For best calcium utilization, certain levels of protein and phosphorus are necessary. Milk supplies all these nutrients simultaneously as well as essential vitamins. For this reason, milk is considered the best calcium source for that great majority who do not have an allergy to it.

CALCIUM UTILIZATION

The problem of obtaining sufficient calcium daily is dependent first on its presence in foods in a chemical form which is available to man; i.e., that it not be an oxalate; and secondly upon its utilization. Unfortunately, food-calcium from whatever source is not utilized efficiently by man. Steggerda and Mitchell *(J. Nutrition* 17:253, 1939) found the range of utilization to be 18 to 49 per cent with an average of 29 per cent of the calcium of milk. To illustrate this poor utilization; one of their subjects showing a negative calcium balance of 110 mg. needed to ingest 540 mg. calcium to change to approximately zero loss or equilibrium. Thus, his utilization was 20 per cent.

Breiter *et al (J. Nutrition* 21:351, 1941) reported that their experimental subjects fell into two groups; those who utilized 30 per cent or more of milk-calcium and those who utilized 20 per cent or less. The average was 24 per cent. If non-milk sources of calcium are used, the quantity of total calcium required may be increased. There is evidence that the calcium of plant foods it not as well utilized as that of milk. According to Breiter, only 13 per cent of the calcium of carrots was utilized.

There is no explanation for individual differences in calcium utilization at the present time. It is apparently not related to sex, age, or nutritional status as respects calcium. A human subject even grossly depleted may retain less calcium than one who has been known to be in positive balance for a long period. In this respect, man differs from the rat in calcium utilization. Under partial calcium deficiency, a rat can utilize almost all the calcium ingested while man excretes at least two-thirds of the calcium ingested.

Calcium retention was studied in young college women 17 to 25 years of age. Mean daily intakes of 0.8 gram calcium, 1 gram phosphorus and 54 grams of protein were required to maintain equilibrium among 124 subjects studied. It was noted that at corresponding intakes, women on self-chosen diets retained less calcium than those on well-selected basal diets. This was especially noticeable for subjects who were ingesting less than 0.8 gm. calcium daily. It was concluded that the calcium *requirement* of young women of 17 to 24 years can best be met by including at least *three cups* of milk in the daily dietary. *(J. Nutrition* 24:367, Oct. 1942) This conclusion specifies requirement, and not, standard; thus it does not include the 50 per cent margin of safety that standards are generally expected to include.

Balance studies by Owen *(J. Biochem.* 33:22, Jan. 1939) on 10 adults, 32 to 60 years of age were done on diets containing 0.53 gm. calcium with 0.85 gm. phosphorus (Diet 1) and 0.88 gm. calcium and 1.23 gm. phosphorus (Diet 2). On Diet 1, four subjects were in positive calcium balance, five were negative and one was in equilibrium. (0.53 gm. could be supplied by an average diet with one added cup of milk, although it usually requires one and one-half cups. Diet 2: basal plus two and one-half cups). At the higher diet level, (Diet 2), nine were in positive balance and one was negative. Intake was 0.879 gm. and output was 0.727 gm. These investigators concluded that the calcium requirements of older men are much the same as those of younger adults.

VITAMIN D EFFECTS ON CALCIUM REQUIREMENT

Addition of five hundred I.U. of viosterol had no influence upon calcium retention of six young college women while they were on a well-selected basal diet and 0.5 to 0.8 gm. of calcium per day. (*J. Nutrition* 26:153, 1943). At intake levels of 0.8 gm. or above, there was evidence of slightly better utilization of calcium by the women, but these differences did not prove to be significant statistically.

These findings have been interpreted in some quarters as proof that adults do not require supplementary vitamin D. Before accepting such interpretation, it is well to analyze the experiment. Only six subjects were studied, whereas there are indications of wide variation in calcium utilization. Nor were the effects of different environments tested. The studies were made in Kansas and Ohio during the regular school year. College students are probably out of doors during daytime hours to a greater extent than other adults, with thus better opportunity for natural vitamin D activation. The intakes of calcium were above those of the average adult and their basal diets were superior. Effects of higher levels of vitamin D were not studied. Johnston (*Am. J. Dis. Child.* 67:265, 1944) found that calcium retention of older girls was better with 3900 I.U. of vitamin D than with 1950 I.U.

Until more data are available, it would seem wise to include vitamin D for those adults not subjected to regular sunshine activation.

SIGNIFICANCE OF NEGATIVE CALCIUM BALANCES

Unlike some elements, notably chlorine and sodium for which excretion is decreased if intake is low, the normal excretion of calcium remains fairly constant regardless of intake. Nor is there anything abnormal in the calcium blood levels of those with lowered calcium intake.

Typical American diets without beverage-milk will furnish not over one-third of the daily calcium needed. If it is not supplied by the food, the calcium necessary for daily utilization by the body must be taken from the bones. Withdrawal occurs from bone which is most active physiologically—the spongy bone of the metaphyses, especially of the long tubular bones, and the bones of the skull and lower jaw (Jaffe, Bodansky and Blair; *Arch. Path.* 12:715, 1931). These areas are analagous to the glycogen of the liver. Osteoporosis may set in fairly early in mature life, but no good tests or signs are available for ready clinical diagnosis. In fact, it has been demonstrated that 50 per cent of the mineral may have been withdrawn from bone before changes are visible roentgenographically (Freeman; Seminar, Ann Arbor, Mich., May, 1946). This lack of diagnostic tests may account in part for the casual attitude toward provision of calcium, phosphorus and perhaps, vitamin D, in the diet of the adult.

The question then is, how adequately does the pint of milk commonly recommended for adults satisfy their needs? In a balance study of three men and four women, 22 to 42 years of age, given vitamin D and one pint of milk

added to the basal diet, six would have had enough to maintain and store some, but one man would have drained calcium from his body at the rate of 32 mg. daily. (Outhouse, *Nutrition News* 4:11, Feb. 1941). In order to be in equilibrium, this man would have had to eat five times 32 mg., or 160 mg. more than that contained in one pint, since he could utilize only 20 per cent of the calcium he ingested. Thus he needed a scant two-thirds cup more than one pint, or a total of 0.981 gm. a day for equilibrium.

Smaller amounts of calcium are more efficiently utilized when the diet is so selected as to provide adequately for other dietary essentials than is the case in self-chosen diets *(J. Nutrition* 26:153, 1943). With these experimental results in mind, it would appear that three cups of milk daily is a safer recommendation for those on self-chosen diets than the pint of milk usually stated.

The pint of milk does not assure a margin of safety for all, and may permit calcium loss from the bones. If there has been such loss, how long a period of liberal calcium feeding might be required to bring skeletal tissues of the undernourished to the desired stage of calcification? This too is not known. Holmes *(Nutrition Abst. and Rev.* 14:22, Apr. 1945) has stated that it is "undoubtedly wise dietary procedure to allow additional calcium for those known to have been seriously restricted in calcium for an extended period of time." But what of those with less obvious restriction?

IRON

Iron is another mineral which may be of greater importance to dentists than hitherto considered. Darby *(J. A. M. A.* 130:380, Mar. 1946) says that:

> Iron deficiency alone is a common cause of oral lesions.—These may be angular fissures, superficial glossitis, (but not the scarlet like glossitis of pellagra) blotchy, irregular denudation of papillae, lesions often confused with oral signs of B-complex deficiency.

These signs may respond to iron therapy alone, according to Darby's experiments, often after they had failed to yield to B-vitamin therapy. He gave 0.3 gm. ferrous sulfate three times a day. Responses occurred in one to three weeks, with no relapses as so often seen following B-therapy. Darby also states that correlation of oral signs and hemoglobin levels of persons studied in nutrition surveys show a high frequency with low levels of hemoglobin.

IMPORTANCE OF ALL FOOD GROUPS

The data reviewed with respect to calcium and iron needs and utilization serve to reëmphasize the importance of all food groups in the diet. The balanced diet must be our guide until more specific criteria and tests for insufficiency are perfected. Even such tests may not be comprehensive enough. Many studies including those of Sherman, suggest that there may be a wide range between the amount of food essentials necessary to prevent signs and symptoms of deficiency and the amount which leads to optimum health.

One of the most difficult and controversial aspects of the problem of requirements concerns the question of what criteria of health should be accepted as a measure of

satisfactory nutrition . . . Some investigators accept the absence of the readily observable lesions pathognomonic of dietary deficiencies as an adequate criteria of satisfactory nutrition. In other words, they doubt that the benefits to be derived from nutrition extend beyond the prevention of dietary deficiency disease, or feel that the further effects that have been described as due to improved nutrition are of minor importance so far as the total health picture is concerned. There are others who consider health to have more positive attributes and use as criteria of satisfactory nutrition that level of nourishment which will lead to optimum growth, development, efficiency, and resistance to disease. *(Nutrition Rev.* 3:294, Oct. 1945)

SUMMARY OF DIETARY NEEDS AND RECOMMENDATIONS

Most instances of human nutritional deficiency may be ascribed directly to insufficient intake of essential food factors. Occasionally, conditioning factors may be operative in producing nutritional deficiency. Such is the case in diseases of the intestinal tract, liver, or in therapeutic use of sulfa-drugs. But the greater number of cases of poor nutrition are due to poor food habits. Such habits persist because of poverty, lack of knowledge of food values, indifference, and lack of criteria for judging the lesser dietary inadequacies.

Few pattern their food habits after science. Rather, such habits are brought about by a mixture of religious beliefs, tradition, notions, taste, and so-called "instinct". Although food habits may not always be based on nutritional needs, traditional food habits of peoples who have survived successfully in their environment must necessarily supply essential substances. For example, use of sprouted seeds by oriental peoples has been shown to be sound nutritionally. Such sprouting increases vitamin content greatly, while the legume seeds contain protein of high biologic value. The lime used in the treatment of corn during the preparation of tortillas contributes a significant quantity of calcium to a people whose diets are otherwise calcium-deficient (Harris, *Science* 102:43, July 1945). Or again, as little as six grams of hot chili will furnish the entire daily allowance of vitamin A.

Continuance of complete traditional patterns are not possible in the United States. The great inter-mixture of peoples from many areas, advertising pressures, shipping and storage facilities produce alteration in habits. Many times imbalances have been created in the diet pattern by omission of items and inclusion of others not filling the same needs. The present day consumption of sugar, yes, even under rationing, or the substitution of bread for potatoes are examples.

In some areas of the world, lack of a sufficient food supply or lack of money with which to buy adequate food are prime factors in poor nutrition. These are not the main deterrents in the United States. In spite of certain shortages, we have in the main, both the food and the money. But the purchases all too often are unwise.

Nutrition education, keyed toward motivation to improve dietary habits is needed. The consumer must learn to like and accept the foods which have been shown to be important to his health and well-being. Study of methods has indicated that individualized education is essential to success in any effort

to improve food habits. This is where the dentist enters the picture. Whether one believes that diet has a specific effect on periodontal tissues, their health or disease, or whether good diets are considered important only as they affect the overall health status of the patient, the dentist cannot escape the influence of food habits on his patient. Thus the matter cannot be left to the physician alone.

At present, because of insufficient data and criteria, the problem of assessing nutritional status is similar to that of assessing intelligence. For example, school medical officers grading the nutritional status of the school child showed inconsistencies comparable with those of examiners marking scripts (Jones, J. Roy. *Statistical Soc.* 101:1, 1938).

The specific effects of faulty nutrition on the health of the adult have not been investigated to any extent. You and I will grow, just as will plants, even when some dietary substances are lacking, but growth will be different. These differences must be investigated. Work which has been done suggests that many ailments commonly attributed to age, may be due instead to continued mild deficiencies.

Until more specific criteria of dietary adequacy are available, the standards set up by the Food and Nutrition Board of the National Research Council should be used as the pattern of good nutrition toward which to strive. Some believe these standards are too high for general use. If so, is it not wise to have a margin of safety in the diet as with other ventures in life?

The seven-day record, divided into meals, is a good tool for diet survey, making possible an estimate of average intakes and probable shortcomings. It is a basis too, for emphasis in teaching the patient a good diet pattern. Even so, careful studies of the same individuals or families at different periods have indicated that the record for any particular period cannot be considered as typical of the food habits of the family or individual. Food habits are apparently not as fixed as is often supposed. This favors establishment of improved habits.

Histories obtained by discussion or by questioning the patient do not give as reliable data as do written records. Records clearly demonstrate the customary great variability of the diet from day to day and week to week. The patient's observance of his own food intake record usually prompts him to insist that his diet is usually better. Actually, the written record more often portrays a diet which is better than the customary one. The fact that the patient sees his diet written out, stimulates him to modify his usual habits. This may not always be done intentionally, but since his attention has been called to diet, he often adds those foods he knows he should be getting. Specific inquiry may bring out that milk or other protective foods were included only recently, perhaps after the patient suspected or knew something was wrong with the gums. Even despite its drawbacks, the dietary record gives information as to whether important protective foods are eaten at all, and if so, how often.

In keeping the diet record, it is important to note where the meals are eaten—in the home shortly after preparation or in a restaurant where steam-table storage may reduce nutritive content. Likewise it is well to go over the record

DIET ANALYSIS
Periodontia Cases

Name of Patient ..... Date .....

Registration No. ..... Periodontia No. ..... Date of X-ray Examination .....

Age ..... Sex ..... Height ..... Weight ..... Number of Teeth Present .....

Type of Case: (Draw a circle around class number)

PERIODONTIA CASES

Arranged for students
- Class 1—With slight bone loss.
- Class 2—Moderately advanced with average bone loss up to ⅓.
- Class 2+—Advanced, with average bone loss ⅓ to ½.
- Class 3—Very advanced with more than ½ of bone lost.

KEEP A LIST OF ALL FOOD EATEN IN ONE WEEK, with approximate amounts of each serving. For example: 2 slices of bread with butter, 2-egg omelet, cereal with ½ cup milk.

Has there been any change in diet during the past five years? .....

State such changes .....

Name any vitamin preparations used .....

How long have these been used? .....

Dietary suggestions: .....

Remarks: .....

Diet Analysis

CHART FOR DIET ANALYSIS

Mark 1 for each average serving of each food in the proper space.

Standard day	Food	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	Average
1 serving	Meat—fish—poultry								
2 cups	Milk (cheese)								
1	Egg								
4-6 servings	Butter, cream								
1 serving	Citrus Fruit—tomato (high Vitamin C)								
1 serving	Fruit (other)								
1 serving	Vegetable (yellow or green)								
1 serving	Vegetable (other)								
1 serving	Potato								
2-3 servings	Cereal foods (enriched)								
2-3 servings	Cereal foods (whole grain)								
	Sugar								
	Vitamin Supplements								

	Above Standard	Standard	Questionable	Low	Very Low
Total Protein					
Efficient Protein					
Calcium					
Phosphorus					
Iron					
Vitamin A					
Vitamin B (complex)					
Vitamin C					

Diet Analysis

with the patient to be sure you understand the relative size of servings eaten, the additions to foods; such as, what is used on the breakfast cereal, on the toast, in the coffee? Vitamin supplements or specific habits applying to food must be noted.

Using the patient's record, the analysis may be made by checking against the diet pattern as set up on the basis of servings daily. A chart for this purpose is herein illustrated.

No single food alone can be used to judge adequacy. All food groups make important contributions and there are many inter-relationships. With present day food-shortages, it may be difficult to fulfill the standard of one serving of meat, fish or poultry daily. Substitutions for the protein contribution of this standard should usually be of animal source, although legumes (dried peas, beans, lentils) of one and one-half cup servings each can be safely substituted once each week. Comparable amounts of protein will be supplied by servings of one-half cup cottage cheese, or, three eggs, or three cups milk. Since the total protein standard is based on one egg and two cups milk daily in addition to the serving of meat, the listed substitutions for meat should supplement and not replace these items in the standard pattern.

Recommendations for change or improvement of the patient's diet should be in specific terms, using the daily pattern as a guide. It is not enough to say, "Eat lots of fruit and vegetables." Instead, say, "Eat not less than five servings of fruit or vegetable each day. One should be citrus fruit or tomato, one bright yellow or bright green, one potato, plus two other servings." The patient should be encouraged to make his own frequent checks against the standard pattern. It requires thought and effort to eat properly.

To many peoples in Europe and Asia, the diets we suggest as essential for well-being, exist only in a dream world. We can help these people and ourselves too, by learning to use a diet-pattern which will provide liberal quantities of important foods. Our caloric intake could be reduced safely if more attention were paid to quality. Increased use of quality foods such as the perishable fresh fruit and vegetables, including potatoes, fresh milk, fresh meat, poultry and fish, the foods insufficient in so many of our diets, will not only improve our nutrition, but will save cereals, sugar, fats, and oils for shipment overseas.

Food should be used wisely, and at all times, waste should be avoided. We must remember too, that it is not enough for meals to be colorful, tasty, nor to satisfy the pangs of hunger. Only when they supply at the same time, the many dietary essentials in liberal amounts, can we expect to get the highest benefits from eating.

832 LaSalle Bldg.

(Series Concluded)

Nutrition and Dental Health will be continued in future issues of the Journal of Periodontology under several aspects. Nutritionists will be invited to submit material which is pertinent to the subject; current literature will be briefly reviewed or abstracted; and a Question and Answer section will be available for any who may wish to use this service. Please mail any questions directly to the Journal Editor.

Editorials

To Build or to Tear Down

THESE are days when much criticism is being leveled at individuals, the professions, business men as a class, and institutions of various types,—even at our democratic form of government. The criticism comes from all sources. In fact it has become a national habit and somewhat tiresome. It seems that too much has been expected of the average human, for most of us are selfish, thoughtless, superficial, disinterested in the welfare of others, and out to get rather than to give.

This dour description of the average person ought not to be applicable to members of the healing professions since their chief aim should be giving honest service rather than getting compensation therefor, regardless of the importance of the latter when conditions call for it. There have been and still are thousands of dentists whose lives have been devoted to the advancement of professional ideals. Their devotion lives in the many fine organizations and institutions in dentistry, and in dental literature. In contrast to these men there are dentists who discredit idealism by stating that it is impractical. They try to erase the fine line drawn between professional and business ethics. Some business men laugh at professional ethics because they do not understand them. Unfortunately, some members of professions also do not comprehend the true meaning of professionalism.

The better dental schools have maintained professional standards and objectives through the years. It was not so long ago that other dental schools were in business and used to help support, in part, universities. It has been stated that dental diplomas could then be bought. Such conditions no longer exist and now no one questions this improvement in dental education which was brought about by those who believed in dentistry as a *profession*. While change is usually difficult to accept even when it means improvement, because it demands readjustment in our thinking and actions, we are in a changing world and might as well get accustomed to changing conditions. However, these very changes are a challenge to us to see to it that what changes are being made are wise ones. This is especially true of changes contemplated in dental education and in dental practice. We have never had such an opportunity as now to show the stuff of which we are made. If we are as good as we think we are we should be able to prove it.

Internal dissension is being encouraged by our enemies. We have no time for this. Too many serious problems lie immediately ahead that will require great action and our entire reserve of loyalty to dentistry. Some of the recent criticisms of dental schools and organizations representing the highest form of professional ideals in education and honor societies have had a destructive influence. One should not judge any organization by an individual member because everyone is liable to error in action and judgment. Instead of tearing down and throwing the bricks around,—truth, honesty, and charity would put out the fire causing so much smoke. One should not be a tool except for

building purposes. It is better to lift one's opponents through understanding to a higher level, than to be pulled down by appeasement. The trend is to erase all signs of distinction of class and to put everyone on the same plane. If the level could be high enough the plan might be more reasonable. But we must condemn every effort to drag anyone down to a lower plane of opportunity and understanding.

We believe that professionalism as applied to dental literature, dental organization, and dental education is on a higher basis than any other approach regardless of how slight a deviation from this standard.

"Ideals are like stars.
You cannot touch them with your hands
But, like the sea-faring man on the desert of waters
You choose them as your guide,
And following them, you reach your destiny."

CARL SCHURZ

G.R.S.

The New Journal of Endodontia

IT IS with pleasure that we welcome an addition to current dental literature, the *Journal of Endodontia* which is being published by the American Association of Endodontists. The first issue, March, 1946, contains a report on the founding of the Association of Endodontists in February, 1943, by Louis I. Grossman and of the first annual meeting in February, 1944. The objectives of the society are described in detail by Edgar D. Coolidge, and "The Bacteriologic Aspect of the Pulpless Tooth" by Robert G. Kesel. The Editor is Balint Orban.

The Journal is to be issued quarterly and the subscription price is $2.00. Any dentist interested in what can be and is being done in the treatment of pulpless teeth should subscribe for the publication. It is to be hoped that this journal will develop rapidly and that the faith of its promoters in the dental profession will be well invested. It is a courageous thing to launch a new dental journal. We congratulate those responsible and wish them success.

Periodontia and endodontia are two closely allied divisions of dentistry and should support each other in advancing the scientific aspect of dentistry. Every periodontist should read regularly the Journal of Endodontia.

Erratum

On account of misinformation received from the home city post office of Major Samuel Cripps (journals mailed to him there were returned, marked "deceased") we assumed that this Academy member was a war casualty and therefore published his name *In Memoriam*. He had enlisted in the Canadian Dental Corps in 1939 and was later in service overseas. We are glad to correct this error.

Major Cripps is living in England. In a recent letter to the Secretary of the American Academy of Periodontology he stated that he was applying for his discharge in England and planned to continue his practice of periodontia in London.—Ed.

BOOK REVIEW

Clinical Pathology and Treatment of the Dental Pulp and Periodontal Diseases. By Edgar D. Coolidge, B.S., M.S., D.D.S. *Second Edition.* Thoroughly revised. Philadelphia, Lea & Febiger, 1946. 511 pp. 350 illustrations.

The author of this book is well known as a teacher and writer. Dr. Coolidge was formerly Professor of Materia Medica, Pharmacology, and Therapeutics of the School of Dentistry, University of Illinois and he is now Professor of Therapeutics, Preventive Dentistry, and Oral Hygiene, Chicago College of Dental Surgery, School of Dentistry, Loyola University, Chicago, Illinois. The author's contributions to current dental literature have been valuable and numerous. He is President-elect of the American Academy of Periodontology and active in the American Association of Endodontists. Dr. Coolidge is a serious student of any subject he undertakes to master and because of his experience and knowledge is well qualified to discuss the two main subjects chosen as the title of his book—*Clinical Pathology and Treatment of the Dental Pulp and Periodontal Tissues.* The book is not divided into two parts as one might expect, but the subjects are consistently blended in a series of chapters.

Those chapters dealing primarily with the dental pulp are under the following main headings: Dental Pain and Its Diagnosis, Treatment of the Dental Pulp in Which Vitality Should Be Preserved, Treatment of Vital Pulps That Should be Removed, Removal of the Pulp and Preparation of Root Canals for Filling, Anatomy of Root Canals With Relation to Pulp Removal and Root-Canal Filling, Principals and Technique of Filling Root Canals, Healing and Repair After Pulp Removal and Root-Canal Filling, Treatment of Infected Pulps and Pulpless Teeth, and Treatment of Teeth with Inflammatory Disturbances of the Apical Periodontal Tissues. These chapters comprise nearly one-half of the text.

The author's long experience as a researcher and teacher, and in clinical practice enabled him to use both the scientific and practical approach to each subject discussed. This results in a very satisfactory book for all dentists. In spite of the many years of keen interest in research the author never once forgets the needs of the majority of his readers who are dentists in general practice. The style of the entire book is clear, readable, and exact. There is left no doubt in the reader's mind as to what is meant. The references are all at the bottom of the pages which is always a convenience for the reader. The illustrations, many of which were gathered from the author's clinical practice, are numerous, well-selected, and add much interest to the text.

The remaining 271 pages are used in the discussion of the pathology, prevention, and treatment of periodontal diseases. The first chapter is on Oral and Dental Hygiene, the purpose and practice of the latter. This is followed by a chapter on Dental Prophylaxis. Dr. Coolidge has made generous references to the works of others and yet in this chapter no reference is made to the writings of Dr. D. D. Smith who introduced the principle of prophylactic treatment at regular intervals and did more than anyone else to establish the idea and method in dental practice. He used the term "Oral Prophylaxis" to designate it, and used hand methods of polishing, exclusively. He designed a set of instruments for the work and applied Oral Prophylaxis in his own practice over a period of approximately twenty years. He also treated successfully many cases of advanced periodontal disease by conservative methods.

There are five chapters on gingivitis: Treatment of Gingivitis Caused by Mechanical Irritants, Treatment of Gingivitis Caused by Dental Calculus, Treatment of Gingivitis Caused by Infection, Gingivitis Associated With Systemic Disturbances, and Hyperplasia of the Gingival Tissues; Hypertrophic Gingivitis. The author states that, "It is difficult to find gingival tissue which does not show inflammation when studied in microscopic sections. Gingivitis that can be observed by clinical examination appears as grossly inflamed tissue under the micro-

scope," and "The prognosis of gingivitis due to any cause is usually favorable." Also, "Gingivitis is a symptom of something wrong and should never be overlooked nor neglected." Dental calculus is thoroughly discussed as to its formation and removal. The author acknowledges the assistance of Dr. Maynard K. Hine, "in revising the chapter on Gingivitis Caused by Infection toward which he has contributed valuable new material of his own." This chapter covers the bacteriology of the mouth with instructive illustrations and the main subject is discussed with a thoroughness that is characteristic of both the author and Dr. Hine,—twenty-nine pages on Vincent's Infection. An interesting departure from the usual is the discussion of gingival hyperplasia in a separate chapter. This condition is sufficiently common, important, and different from the usual forms of gingivitis to warrant its separation from them. Twenty-five pages are devoted to it.

Three chapters are given over to the consideration of the more advanced and less well understood conditions affecting the periodontium. A part of Chapter XIX is on the Functional Changes in the Periodontal Unit That Relate to Overloading. This is especially interesting to periodontists. The treatment of suppurating periodontal pockets is discussed in Chapter XX. This chapter will be a disappointment to the more conservative periodontists as the impression is left that emphasis has been placed on radical measures, with a conservative approach, however. This reviewer especially commends the chapter on Periodontosis and Its Treatment. This condition should be generally recognized by dentists and a distinction made between it and other diseases involving the periodontium. It appears to be increasing in young adults, and is too serious to be over-looked or wrongly diagnosed. There can be no doubt that this is a medical problem as well as a dental one. The final chapter is on the Treatment of Atrophy of the Periodontal Tissues.

Dr. Coolidge has again made a valuable contribution to dental literature. This reviewer has read his book with satisfaction and pleasure and will now study more carefully the scientific portions which are written in easily understood language, for which all dentists will be grateful to the author.

—*G.R.S.*

Annual Meeting Program

AMERICAN ACADEMY OF PERIODONTOLOGY

Birmingham, Alabama

OCTOBER 17, 18, 19, 1946

THURSDAY, OCTOBER 17

9:00 A.M.—Registration

9:30—First Session of the Twenty-Ninth Annual Meeting
Samuel R. Parks, President
Report of Officers and Committees
Committee on Program
Committee on Clinics
Committee on General Arrangements
Committee on Scientific Investigation
Committee on Nomenclature
Committee on Journal Subscriptions
Committee on Ethics
Committee on Credentials
Special Committee Reports

11:00—Presidential Address
Samuel R. Parks

2:00 P.M.—Glossitis
Arvin W. Mann, Fort Lauderdale, Florida

2:45—A Study on Reattachment
Frank E. Beube, New York City, New York

3:00—The Planning of Mouth Rehabilitation to Offset Periodontal Disability
B. F. Sapienza, Birmingham, Alabama

3:45—Hypoproteinemia (Amino Acid Deficiency) A Probable Factor or Co-factor in Producing Periodontal Lesions
J. A. Sinclair, Asheville, North Carolina

FRIDAY, OCTOBER 18

8:00 A.M.—Past-Presidents' Breakfast
Robert L. Dement, Chairman

9:00—Report of Past Presidents' Meeting
Robert L. Dement

9:15—Committee on Scientific Investigation
Hermann Becks, Chairman

ANNUAL MEETING PROGRAM *(Continued)*

Traumatic Occlusion and the Resorption of the Mandible
B. Gottlieb, Dallas, Texas

Grinding for Trauma—Four Discussers

12:30 P.M.—Luncheon—Academy Round Table
Clark E. Chamberlain and Dorothea F. Radusch, Leaders
(Table Chairmen to be announced)

2:30—Clinics
Harold G. Ray, Chairman
(Clinicians to be announced)

7:30—Annual Banquet—Ball Room, Thomas Jefferson Hotel

SATURDAY, OCTOBER 19

9:15 A.M.—Some Unusual Periodontal Problems.
Balint Orban, Chicago, Illinois

10:00—Treatment of Periodontal Involvements
Howard A. Hartman, Cleveland, Ohio

10:45—Diagnosis Procedure in Periodontal Practice
E. Romle Romine, Detroit, Michigan

11:30—Election

12:30 P.M.—Luncheon Meeting of the Old and New Councils

4:00-6:00—Informal Tea for Members and Guests

NEWS RELEASES FROM A.D.A.

For Release March 31, 1946

Great caution must be observed in the use of fluorine in control of dental decay, Dr. Philip Jay, of Ann Arbor, Michigan, declared today in *The Journal of the American Dental Association.*

Dr. Jay, a member of the faculty of the School of Dentistry of the University of Michigan pointed out that fluorine-bearing domestic water has been conclusively proved to inhibit dental caries among children.

He warned, however, that the prospect of fantastic exploitation of fluorine in dental caries control is a "menacing possibility."

"It is definitely established," he wrote in the April issue of the *J.A.D.A.*, "that fewer carious dental cavities occur in persons continuously resident in fluoride areas during the first eight years of life than in persons residing in fluoride-free areas."

Dr. Jay cited records compiled by dentists in the neighboring communities of Oak Park and Maywood, Illinois, as typical of findings in fluorine research.

Maywood, with a water supply containing 1.2 parts per million of fluorine, has a caries rate of 258 (the number of permanent teeth with caries experience per hundred children 12 to 14 years old), as compared with the high caries rate of 722 in Oak Park, which is supplied with fluorine-free Lake Michigan water by the City of Chicago.

The evidence, however, is still insuffcient to warrant the universal treatment of water with fluoride, Dr. Jay declared.

Neither should fluorides be used in mouthwashes or dentifrices, he asserted. He attacked as "extravagant" the claims made for bone meal products which contain fluorides.

Dr. Jay urged that communitics wait for results in experiments being conducted at Grand Rapids, Michigan, and at Newburg, N. Y., before rushing in to add quantities of fluorine to their domestic water supply.

"It remains to be seen whether the addition of fluorine to a fluorine-free water will be accompanied by a decline in the rate and intensity of caries attack in a population exposed to water so treated," he wrote.

At both Grand Rapids and Newburg, the water now contains approximately one part per million of fluorine. Trends from these experiments will not be discernible before 1950 and possibly later, Dr. Jay declared.

Too much fluorine in water tends to cause mottled tooth enamel. A dosage as high as 4 grams of sodium fluoride is usually lethal, Dr. Jay said. He added, however, that no toxic effects are believed possible with fluorine limited from one to one and one-half parts per million in drinking water.

Dr. Jay recommended that if the treatment of public water supplies proves bene-

ficial, children in rural areas might be benefited by internal medication with small doses of sodium fluoride.

Fluorine has been applied topically to teeth of children with considerable success in reducing the incidence of dental caries, but these experiments are not sufficiently advanced to draw final conclusions, he said.

In several controlled tests, temporary reductions as high as 50 per cent in the incidence of dental caries have been achieved. All of the favorable results, however, were obtained in children 7 to 15 years of age. Results among adults have been negative, Dr. Jay reported.

For Release June 2, 1946

The Council on Dental Therapeutics of the American Dental Association today reported that Dr. Cornish's Tooth Powder, manufactured by the Cornish Laboratories, Berkeley, Calif., is not acceptable for Accepted Dental Remedies.*

The report declared:

"The product is stated to contain vitamin D, calcium fluoride in the form of fluorite, and urea. Preliminary tests in the A.D.A. Bureau of Chemistry indicate that the bulk of the product consists of calcium carbonate and calcium phosphate. The firm has declined to reveal the composition. Claims for the product are essentially that it cleans, hardens and preserves the teeth, that it stops decay in most small tooth cavities and that it cures most cases of gum bleeding within two weeks . . .

"The Council is not aware of evidence adequate to support the claims for the product made in the advertising and on the labels. The use of the title 'Dr.' as part of the name of the product is misleading and in violation of the Council's rules. Dr. Cornish's Tooth Powder is therefore not acceptable for A.D.R.*"

April 10, 1946

**Accepted Dental Remedies*, American Dental Association, Chicago 11, Ill.

CERTIFICATE OF TRAINING IN PERIODONTOLOGY

Columbia University, School of Dental & Oral Surgery

General Information

This course is offered to provide opportunities for advanced study in the field of periodontology. All regulations contained in the 1946-1947 announcement of Certificate in Training courses apply to this course. The period of residence will be one academic year consisting of two semesters, 16 weeks each, beginning September 23, 1946. The hours of study will be from 9 a.m.-4:30 p.m. daily, and 9 a.m.-12 noon on Saturday. The registration time and fees will be similar to those listed for the general course in Restorative Dentistry. The instruments required are described in the instrument list, code letter "E". The courses of instruction are listed below.

CERTIFICATE COURSE IN PERIODONTOLOGY

WINTER SESSION

Dentistry 305 Clinical Practice in Periodontology. 5 Points

5 sessions per week; Monday through Friday. Professor Leonard, and Staff.

Clinical practice will consist of demonstrations and practice in diagnosis charting, treatment planning, the conservative method of treating periodontoclasia, the surgical method and occlusal equilibration.

Dentistry 323 Oral Pathology. 1 Point

8 one-hour lectures: 8 laboratory sessions. Professor Cahn.

Clinical pathology of the oral cavity, including diseases of the jaws, teeth; tumors of the oral cavity; oral neurology, diseases of the pulp and periapical tissues and of the gingivae.

Dentistry 325 Aspects of Internal Medicine Related to Dentistry. 1 Point

One-hour lecture weekly for sixteen weeks. Dr. Werner, Professor Ziskin.

Physiology and diseases of the endocrine glands;

vitamin deficiencies; calcium, carbohydrate, fat and protein metabolism; blood dyscrasias; cardiovascular diseases and arrhythmias; diarrheas, acidosis and alkalosis; bone and joint diseases.

Dentistry 329 Diagnosis. 1 Point

16 one-hour lectures. Professor Ziskin.

Instruction in X-ray diagnosis and diagnosis of soft tissue Lesions of the mouth.

Dentistry 331 Microscopic Anatomy. 1 Point

One hour lecture and 2 hour laboratory sessions weekly for eight weeks. Professor Lefkowitz.

Fundamentals of the microscopic anatomy of the dental tissues. Special emphasis on the hystophysiology of the periodontal structures.

Dentistry 337 Theory and Practice of Restorative Dentistry. 3 Points

Two one-hour lectures each week. Professors Oman, Smith, Young, and Staffs.

Selected lectures, motion pictures, and demonstrations of restorative methods and techniques.

Dentistry 341 Theory and Practice of Periodontology. 3 Points

Two one-hour lectures each week. Professor Leonard and Staff.

Lectures embracing subjects of diagnosis, charting, treatment planning, Vincent's infection, nutritional and metabolic factors, physiology and pathology of the supporting structures, replacement procedures and development of periodontology methods.

Dentistry 343 Thesis Requirement. 2 Points

Four hours a week for sixteen weeks.

The student is required to submit a thesis outline on an approved subject. Upon approval of this outline, clinical, theoretical and laboratory data relating to the problem are collected.

SPRING SESSION

Dentistry 306 Clinical Practice in Periodontology. 5 Points

Five sessions per week. Monday through Friday, Professor Leonard and Staff. Continuation of Dentistry 305.

Dentistry 314 S Nutrition and the Individual. 1 Point

Sixteen one-hour lectures. Professor Zucker.

A review of basic facts of nutritional essentials, with a discussion of available data on variable nutrition as it affects well-being and growth in laboratory animals. Application to man will be made by an analysis of selected growth studies, with emphasis on the skeletal system.

Dentistry 320 Related Clinical Practice. 1 Point

Sixteen two-hour periods. Professors Ziskin, Stowe and Staff.

Clinical practice in mouth examination; charting, X-ray interpretation; pulp testing. Emphasis on comprehensive oral diagnosis.

Dentistry 322 Physical Diagnosis. 1 Point

Ten two-hour lectures. Professor Hanger.

Survey of the general background of methods employed and information to be elicited in physical diagnosis. This course provides a cultural background in medical diagnosis.

Dentistry 324 S Elementary Biostatistics. 1 Point

Sixteen one-hour lectures. Professor Fertig.

Elementary methods of analyzing simple types of data. Methods of evaluating chance variation. Introduction to general concept of correlation. Methods of collecting, tabulating and graphing data.

Dentistry 332 Chemotherapy. 1 Point

Eight one-hour lectures. Four laboratory sessions of three hours each. Professor Fox.

Dentistry 340 Orthodontics Related to Periodontology. 3 Points

Sixteen one-hour lectures and sixteen two-hour laboratory sessions. Professor Totten and Staff.

Lectures and demonstrations of methods of splinting, fixation, and ligation of teeth as well as tooth movement to obtain better alignment to avoid occulusal trauma.

Dentistry 342 Periodontology Theory and Practice. 3 Points

Continuation of Dentistry 341

Dentistry 344 Thesis. 2 Points

Continuation of Dentistry 343

The student is required to submit a written report of his research at least 2 weeks before the close of the session.

The next "In Our Opinion" Discussion will appear in the October, 1946 issue. Subject: "The Nutritional and Systemic Background for some Cases of Periodontoclasia".